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Nature and the Camera

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WOOD-THRUSH FAMILY.

Photographed thirty feet from the ground. The young are ready to leave their nest.

NATURE AND THE CAMERA

HOW TO PHOTOGRAPH LIVE BIRDS AND THEIR NESTS; ANIMALS, WILD AND TAME; REPTILES; INSECTS; FISH AND OTHER AQUATIC FORMS; FLOWERS, TREES, AND FUNGI

BY

A. RADCLYFFE DUGMORE

AUTHOR OF "BIRD HOMES"

ILLUSTRATED FROM PHOTOGRAPHS BY THE AUTHOR

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This little book is dedicated, as a slight token of esteem, to my friend H. W. L., who by the interest he has shown in things natural has earned the gratitude of all students and lovers of nature

INTRODUCTION

As a means of studying nature in most of its many forms, there is, perhaps, nothing better than the camera. Not only does it teach us to see much that would otherwise pass unnoticed, but it enables us to make records of what we see — records that are, as a rule, infinitely better and more useful than pencil notes; and the studying and photographing of one subject leads to another, and so we go from birds to insects, from insects to flowers, and from flowers to trees, until we have an acquaintance with things natural more intimate and far broader in its scope than would have resulted had we been content simply to try to see things and write notes on them.

Nowadays, when every school has or should have its nature class, we find children scarcely out of the kindergarten who know more about our wild birds and flowers than the great majority of the grown-up people to whom nature study was an unknown thing when they were young. To foster this desire in children to know more of the life about them is

one's duty, for not only is there great pleasure to be derived from such knowledge and healthful exercise in the search of material, but knowing something about the birds, trees, or insects enables them throughout life to work intelligently for the preservation of that which needs protection. Game laws would be respected more generally if people would only realise what they mean. The senseless and wanton killing of animal life that goes on all around us would not be tolerated if there was more knowledge of the value of such life. How often do we see people kill hawks, thinking that they are doing a good deed, just as the various Christian sects burned or otherwise killed one another in days gone by, fully believing that such acts were for the good of the world. Let the man who kills a hawk or even a snake first inquire into the habits of that particular kind of hawk or snake, and usually he will find that by killing it he will be doing harm to his own interests. So it will be seen that there is much to be gained by encouraging the study of nature in any or all her forms, and, as has already been said, there is nothing that will give the beginner an interest in the subject any more quickly or with greater certainty than the camera. Nearly every one, young or old, possesses some variety of camera, and yet so few ever attempt the portrayal of anything save people and views! Let them direct their energies toward photograph-

ing the details of almost any common object in nature, and they will be astonished to find how much there is to interest them in that object. Take a photograph of a landscape, and even though it may be beautiful, it is, after all, much like hundreds of other landscapes. But take any one of the objects represented in the view, such as the different grasses, the flowers, or the trees, and how much more interesting would they be if well photographed in detail!

It is in the hope of helping those who are merely beginners in the art of photographing any of the forms of nature that this little book is offered. Knowing how many and varied are the difficulties encountered by the nature photographer, it has been the endeavour throughout these chapters to take note of the principal difficulties that have been met by the author, and, wherever possible, give such suggestions as might be of help in overcoming them. No secrets have been withheld, and any so-called "tricks of the trade" are explained frankly. At best a book of this size can but touch on many of the subjects; to give a full account of how to treat each subject would require many volumes and would prove very tiresome reading. Everything has been made as brief as was thought compatible with clearness, and technical terms have so far as possible been avoided.

The illustrations are of course from life and were selected from a collection of nearly three thousand

negatives made by the author during the last few years.

To the expert in nature photography this book will prove of little or perhaps no use, and he must accept it with the apologies of the author for any statements that may clash with his own ideas. The suggestions and advice given are simply based on the personal experience of the writer and are offered for what they are worth.

A. Radclyffe Dugmore.

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Nature and the Camera

NATURE AND THE CAMERA

CHAPTER I

PHOTOGRAPHIC OUTFIT AND MANIPULATIONS

PART I

APPARATUS

As the outfit necessary for the thoroughly equipped nature photographer is of great importance, the reader must pardon what may appear to him to be an unnecessary amount of detail, and also excuse any statements that conflict with his ideas. Each man sees things in a different way, and I simply give my opinions, which, though based on a fair amount of experience, are not supposed to be final. To influence a man in the choice of cameras or developers or plates would be almost, if not quite, as absurd as trying to tell a man which gun to use. It is not for the advanced student in nature photography that this chapter is written, but for the tyro, who, in beginning the work of photographing things natural, runs up

against a list of apparatus as long as it is perplexing. If he goes to a dealer he will more than likely be recommended to use the things upon which the dealer makes the greatest profit; he also will be induced to buy a number of quite unnecessary things; and as the dealer is seldom a really practical photographer, many of the most important articles will be left out. A great difficulty in giving anything like a complete list of apparatus needed is the constant change in all photographic supplies. A camera that would be best to-day might in a week's time be superseded by something so much better that the older one would be thrown aside for the newer invention. It is not so very long ago that the twin-lens camera, commonly called the "two-decker," was the only camera with which one could focus on an object and at the same time have the plate ready for an exposure. Then came the reflex, and now we have the graflex, which, though expensive, is about all that can be wished for. Being strongly made, it will withstand the rough usage incidental to natural-history photography. Its long draw of bellows allows of the use of a twelve-inch lens, and for objects up to within about ten feet distant a six-inch lens with hand-camera telephoto attachment can be used. The shutter is of the latest pattern of focal plane which works near the plate; by this method the greatest possible amount of illumination is re-

ceived by the plate, so that very short exposures may be given with good results. All these advantages, combined with the ease of focussing on any object, whether at rest or in motion, make such a camera of the greatest possible value to the photographer of animate nature. A bird may be caught on the wing with as much ease and certainty as if it were mounted.

For flowers and many kinds of work the regular long-focus camera will always be useful, but it is well to remember that there is every advantage in having the back focus rather than the front. The reason is obvious. The back focus allows you to keep a certain distance between the lens and the object while you move the back end of the camera until the correct focus is obtained, whereas, if the back is rigid and the front moves, you have much trouble in getting a sharp focus on a very near object, as the distance between the object and the lens changes while you are trying to get the correct focus. Almost all the modern cameras are fitted with convenient reversible backs, and most necessary arrangements they are. It is hard to realise that but a few years ago the whole camera had to be reversed, where now only the back need be moved. The swing-back is another desirable feature in a camera, far more so than the rising front, which is seldom wanted, except where buildings are to be portrayed. The use of the swing-

back is not always understood by the beginner: its object is to enable him to bring both foreground and distance in focus. This is particularly noticeable when the subject in hand is a birds' nest or some such object on the ground, and you have to place the camera low down. The part of the foreground nearest the lens is so very near, while the distance is so much farther off, that, to have the whole picture in even fairly sharp focus, you would have to use the smallest diaphragm, and consequently a very long exposure would be needed. By using the swing-back, swinging the upper part back and the lower part forward, you can to a limited extent obviate this. Remember that the nearer the object is to the lens the greater must be the distance between the lens and the plate, and vice versa; and as the back swings, so does it increase or decrease the distance between the lens and the plate.

In the matter of lenses there are several important things for the nature photographer to bear in mind. Speed is absolutely necessary in most branches of work; depth of focus also is necessary; perfect definition and covering power are equally important. To insure covering power it is advisable to have a lens whose covering capacity is at least one inch greater than the largest plate you intend to use. Then if you use the rising and falling front you can use it without sacrificing definition at the upper or lower end of the

plate. Length of focus is important, in that it governs the size of the object from a given distance. The greater the equivalent length of focus the larger will be the object, and the less will be the distortion due to foreshortening. A short-focus lens foreshortens all objects that are near with such abruptness as to cause grotesque distortion. The most useful lens for all-round work is one whose two systems or combinations can be used separately. By having such a lens you have practically two in one, the single combination having about double the focal length of the couplet. With some of the newer lenses, such as the plastigmat, the single combinations may be used for instantaneous work, while with some of the other highest grade lenses the single combinations can be used only with a small diaphragm. The diaphragm of a lens is used — to give a very untechnical description — to increase the depth of focus and the covering capacity of a lens, thereby giving greater definition at the sacrifice of speed. Each number, such as F 8, F 16, etc., means, for practical use, that the exposure when the larger figure is used shall be double that of the preceding figure; for instance, if, with the diaphragm set at F 16, the exposure needed is one second, at F 32 it would require two seconds, and at F 64 four seconds. It will be seen by this that for instantaneous work the lens must be used either open or with a large diaphragm.

On the subject of telephoto lenses we must confine ourselves to their practical use. The telephoto is an attachment which is used in connection with another lens. It is placed back of the lens and enlarges according to the scale marked on the barrel. As the magnification increases, so is the necessary exposure lengthened, for which reason it will be seen that for instantaneous work a magnification of, say, 10 diameters would be out of the question. With the Bausch & Lomb hand-camera telephoto attachment fitted to the plastigmat lens, exposures of one hundredth part of a second may be made if conditions are very favorable and the magnification is not more than about 2½ or 3 diameters. Of course such a plate must be developed carefully. With an exposure of a twenty-fifth of a second, excellent results can be obtained in bright light. The high-power telephoto lens is only useful when the object to be photographed is still enough to allow of a time exposure. When using a telephoto lens with a hand-camera be careful to hold the camera firmly: the least vibration will ruin the picture.

The tripod, though not a very important part of the outfit, should be selected with care. Be sure to have one that is sufficiently rigid; the legs should telescope and the top be large enough to give the necessary support for the camera. Be sure also that the legs are well separated at the top; that is to say,

they must not come close together near the centre of the top; if they do, the tripod will never be steady.

A word or two about plate-holders may not be amiss, as they are of vital importance. Never choose a holder because it is light. The lighter it is the less wood (if it is made of wood) is used, and consequently the less strength it has. Scarcely any of the plate-holders on the American market to-day are proof against half an hour of strong sunlight, while with most of them the plate would be hopelessly fogged if the sun shone on the holder for half a minute. Even the slides are not really opaque. If they are made of rubber they become soft in hot weather and brittle when it is cold. The paper slides are better, but they wear out quickly and do not stand dampness. The best kind are made of some preparation of celluloid. These are opaque, withstand any cold, but are apt to become soft while they are hot. Any plate-holder which does not allow of the plate being inserted and removed *easily* is not to be recommended, as we often have to change plates in the field, when the luxury of a dark room is of course unknown, and when buried in a sleeping-bag on a hot evening, we do not relish having to remove plates from a holder when they insist on sticking; it is a test too severe for any one's patience.

From plate-holders we naturally turn to changing-bags. There are very few kinds on the market (ex-

cept in England), and it is difficult to find one that is satisfactory. Most of them are good enough for a very short time, but they invariably leak if they are used for any length of time. If made of any material containing rubber, they are useless, as the rubber soon perishes. Of the materials which I have tried, pantasote seems the best. It is absolutely light-tight, and wears well. A simple form that answers for a changing-bag is a square box-shaped bag well reinforced and bound on the edges. At each corner there is a loop to which cords are attached that will hold the bag in position; two sleeve-like openings (with rubber bands to hold them closely about one's arm) on one side admit the arms, and should be made large enough to let the plate-holders enter. For a changing-bag this is all that is needed. Of course we cannot see what we are doing, but that is seldom necessary when once we know our plate-holders.

A really portable field-developing tent is one of the much-needed things. At present there is nothing on the market in this country, though I understand one is about to be made. There are two patterns of these tents or boxes: one in which you put your arms inside, and with your head outside you look through a yellow glass window, another yellow or red window being on the opposite side. This has the advantage of coolness, but it is difficult to see very clearly. The other is a cloth and wood box or

tent with a bag-like opening, which is tied round the waist, so that one's head and arms are inside. In cool weather this is all very well, but in hot weather it is frightfully uncomfortable for one's self and dangerous for the plates.

In going on a long trip it is well to be provided with a small quantity of concentrated developer, two rubber or celluloid trays, and a small red candle-lamp, in order to make a test negative once in a while to be sure that everything is going properly. Nothing can be more disappointing than to find after a long trip that through some small defect in camera or shutter all your work is spoiled; and yet such occurrences are by no means uncommon.

The question of what plate to use is an important one, and one which every man must answer for himself. Almost any of the good makes are good, and generally the complaints made against them are unfounded, those who make the criticisms being usually beginners who think it smart to find fault. For all work where colour-values require to be rendered accurately, isochromatic plates are necessary, the slower kind being most truly isochromatic. With gain in speed there is loss in their sensitiveness to the reds, greens, and yellows. Backed isochromatic plates are the ideal kind, combining as they do all the virtues of both the nonhalation and isochromatic properties. For sky effects they are perfect. Non-

halation plates are those which prevent the blurring around the strongly lighted parts; as, for instance, a window from the inside of a room would be a blur with an ordinary plate, while with the backed or nonhalation plate the edges would be well defined. Ordinary plates will do well enough for snap-shot work, provided they are fast enough. It is well to remember that the more rapid the plate is the less latitude you have in exposure; in other words, the more rapid the plate the more nearly correct should the exposure be. For long trips where weight has to be considered, *cut* films are a good substitute for plates. These, as made by both Carbut and Seed, are really excellent, comparing favourably with glass plates. Their keeping qualities also are good. In using ray-filters — and the best of them are of coloured glass — always use an isochromatic plate; the exposure is of course increased according to the density of the colour-screen. Over-exposure is a common error when the ray-filter is used. With a light-coloured glass and isochromatic plates the exposure is increased about four times with instantaneous plates, while with slow plates it is much less, as the slow isochromatic plates are so much more sensitive to the yellow light.

PART II

THE DARK ROOM, DEVELOPING, PRINTING, DOUBLE PRINTING, RETOUCHING, EXPOSURES

THE DARK ROOM.— A comfortable, airy dark room, though not essential to good work, is nevertheless highly desirable. Much excellent work is done under the most adverse conditions — plates are developed under beds, in bath-rooms, and in all manner of places; but that is no reason why, when it is possible, we should not have a room adapted to, and solely for, developing. Such a room need not be large; four by five feet will do, though it is better for being a little larger. Do not on any account have it in the attic, unless you expect to do all your developing at night. Even then in hot weather you will find it anything but comfortable. The cellar is of all places the most desirable: it is nearly always cool in the summer, and if there is a furnace, it is quite comfortable in the coldest weather.

To make a temporary and easily constructed dark room, use two thicknesses of red building-paper, supported on a rough but rigid framework. The door may be most easily and safely made by taking three thicknesses of black or red Canton flannel, or some such material, and hanging it so that the edges of the cloth overlap. If the bottom has a wide hem

filled with shot or sand, it will keep the curtain in close contact with the floor. The window is easily made by cutting a hole of the desired size and covering it with ruby cloth and orange paper. A lamp on a bracket outside will give the best and most steady light without heating the room. An extra piece of ruby paper or cloth should shield the light when isochromatic plates are being used.

If by tapping the water-pipe you can have running water, do so, as you will find it is well worth the small cost. A plentiful supply of water is the way to be sure of having everything clean, and cleanliness in photographic work counts for a great deal.

Inside the dark room the shelves should be arranged so that there will be a place for changing plates, a place for the developing trays, a small shelf for chemicals and graduates, and another shelf *below* all the others for the fixing-bath. Having this below the shelf on which the developing is done insures one against the possibility of having drops of hypo fall into the developer.

Developing.— While it might be taken for granted that the reader knows how to develop, still a few words may be said on the subject for the benefit of the beginner. Developing a plate is, briefly speaking, subjecting an exposed plate which holds a latent image to the action of certain chemicals which will

reduce the bromide of silver to metallic silver — in other words, the developing agent causes the image to appear. The image will, of course, appear reversed; that is to say, the objects which in nature are black will show transparent, while the white objects become black. This is caused by the action of light on the sensitive film: white, reflecting more light, acts energetically on the film, while black, reflecting as it does no light or scarcely any, has correspondingly little effect on the film.

Now, of the important considerations in making a negative, the first is to have it correctly exposed; the next is to use the developer best suited to the subject and the plate. There are so many developers to-day that it is no wonder the beginner becomes confused in trying to select "the best." It is not so very long ago (up to about 1880, I think) that pyro and ferrous oxalate were the only two; then came hydroquinone, which in turn was followed by the vast number which we see to-day. Some of them are good, but as a rule they are too violent. Pyro still holds its own with those who do not object to its finger-staining properties. With each brand of plates the makers give the formula best suited to the plate, and we cannot do much better than follow their directions. For my own part, I prefer pyro to all others for general work. Occasionally, for a very much under-exposed plate, edinol or metol or some

such developer may be used with advantage, especially in hot weather.

In developing a plate, one should always keep it under control and watch it carefully, so that it may be removed when the proper density is reached. Under-exposed plates need less acid and more water, and over-exposed plates require less alkali, a stronger developer, and a small quantity of restrainer, such as bromide of potassium (ordinary salt will do in an emergency). With a plate correctly timed the quality may be regulated by the relative proportion of the ingredients. Thus when the developer is weak in alkali or over-strong in acid, the plate will give the effect of under-exposure, i.e., will be hard, with decided contrasts and little detail in the shadows; whereas, if the proportions were reversed, so that the alkali predominates, the plate would be flat, lacking contrasts, as in the case of over-exposure. A very weak developer will have the same effect.

A much over-exposed plate may be saved by being placed in a bath containing a small quantity of restrainer and the developing acid, no alkali being used. This bath should be kept in constant motion, or else the plate will have irregular, wave-like markings. When removed from this bath, replace the plate in the ordinary developer, containing some restrainer, and carry the development much further than usual. Under-exposed plates may with advan-

tage be placed in a weak alkali bath for as much as half an hour before development, and then developed slowly with a rather weak developer.

If a plate is too dense, it may be reduced, after being thoroughly washed, by putting it in a bath containing about three per cent. of persulphate of ammonia, then thoroughly washed. A plate that is too thin *but has detail* may be improved by intensifying; but an under-exposed plate having strong high lights and transparent shadows should be reduced rather than intensified. A good bath is made of a saturated solution of bichloride of mercury. When thoroughly whitened, rinse the plate and blacken it in a weak bath of aqua ammonia or sulphite of soda. The plate must be free from all trace of hypo, otherwise there will be yellow stains or irregular intensification.

In all cases be sure to dust your plates carefully before placing them in the tray. Wash the plates thoroughly before fixing, and fix with fresh hypo bath, except when the weather is hot; then the acid fixing-bath recommended by the Cramer plate-makers should be used. It hardens the film and keeps well, and allows of any after treatment that may be necessary for the plate. Another good hardener is formaline (1 part to 16 of water). This may be used either before or after fixing. Its keeping qualities are good, and it may be used repeatedly,

allowing the plate to remain in it for from one to three minutes.

PRINTING.—In making a negative the prints must, of course, be thought of and the plate made that will best suit the paper one expects to use. Each kind of paper requires a certain quality of negative. Although these qualities cannot very well be expressed in writing, they will soon be discovered. The extremes may be said to be albumen, which requires a strong, dense negative, and velox, which gives the best results when the negative is thin and full of detail.

For most printing-out papers (papers which show the image while printing) the printing should be done in the shade if the plate is thin, and in strong sunlight when a dense plate is being printed from. Subdued light increases contrast, strong light decreases it.

Local printing, which often saves a picture, is accomplished by letting the light strike the plate locally, being careful not to have hard edges. A piece of cardboard with a hole cut in it will enable one to concentrate the light on the parts requiring the most printing. Do not, however, place it too close to the plate.

A very flat sky is much improved by allowing the light to fall on the paper very gradually (after the printing is finished and the paper removed from

the frame), letting the upper part become fairly dark, while the lower part remains light. So much can be done by manipulating a print; in skilful hands a poor negative may be made to yield a very fair print, but only after a great deal of practice can much be accomplished.

Double Printing.— There are times when the background of a picture may have been injured, while the central object, be it a person or an animal, is quite clear, or perhaps it is desirable to alter the surroundings of an object. In order to do this, double printing is resorted to. Two negatives are used, one of the background and the other of the figure. (Be sure the two are in correct proportion.) This latter negative is painted out with opaque colour, leaving the figure untouched. Of course the edge must be very carefully followed. Then a print of this figure is made, and that is carefully cut out, thoroughly darkened, and laid against the background negative in exactly the place where it is needed. A print is now made from this negative which, when done, will leave a white space *exactly* the size and form of the figure. The next step is to fit this print against the figure negative and make a print from it. The resulting picture will show no joint, if the work has been properly done. A little retouching on the edge will easily cover up any small defects in the joining.

Retouching and Spotting.— Both negatives and prints may frequently be improved by a little judicious retouching: an outline accentuated, a little detail worked up, or a high light strengthened will often do much to enhance the beauty of a photograph and render it more suitable for reproduction. This retouching may be done on either the negative or the print, or both.

For the negative a balsam preparation known as retouching-fluid is rubbed softly over the film. This gives it a "tooth," so that a lead-pencil will mark it. When fine work is needed, such as in working up the hair on an animal, a very hard and finely pointed pencil should be used, HHHH being none too hard. For softening shadows H is hard enough. Occasionally, where broad masses of shadow are to be held back, a very thin and light wash of pale aniline yellow, applied with a brush, will answer.

In working up a negative, if one has not a regular retouching-frame, lay the plate in a printing-frame, prop it up so as to face a window, and place a piece of white paper in such a way as to throw a reflected light against the plate.

Spotting a negative is simply filling in the small clear spots that are caused either by dust or by bubbles in the developer. The medium used for this is either a preparation known as "opaque," or water-colour paint, or even Indian ink. The density of

the paint must, of course, correspond with that of the plate at the place where the hole is in the film.

For retouching prints both paint and pencil are used. For the platinum papers a soft pencil or charcoal gray and white (water-colour) will serve. With the smooth, glossy papers, water-colours mixed with a little albumen or gum arabic will allow of almost any degree of retouching. In doing work for reproduction, it is often necessary to accentuate detail in the shadows. It should, however, be done carefully, as the photographic effect is easily lost.

Exposures.— There is but one master who can teach us how to expose a plate correctly under all conditions. That master is experience. Correct exposure depends so much on the quality of print we want that it is impossible to give any rules on the subject. An under-exposed plate yields a hard negative with strong contrasts, while the result of over-exposure is flatness — lack of contrast. To a limited extent these defects may be corrected in the developer, but if the plate is very much under-timed, no power can save it. On the other hand, a very much over-exposed plate may, with care, be made into a good negative. So if you are in doubt about what exposure to give, be sure to give enough — too much rather than too little.

CHAPTER II

PHOTOGRAPHING BIRDS AND THEIR NESTS

PART I

NESTS CONTAINING EGGS

Outfit required.— Long-focus camera. Ordinary lens, the longer the focal length the better. Plate-holders. Dark cloth (not rubber). Isochromatic plates. Tripod with fourfold telescopic legs and extra extension legs, attachable. Ball-and-socket camera attachment. Small mirror. White reflecting-cloth. Pair pruners. Lock-saw. Climbing-irons.

ARMED with this apparently elaborate outfit, we will begin with what may perhaps be considered one of the most simple branches of natural-history photography. Photographing a nest, though not difficult except in certain peculiar cases, calls for a considerable degree of artistic sense, for so much depends on the composition of the subject and on the lighting. A nest properly lighted makes a beautiful picture, one that calls for the admiration of all who see it. But look at a photograph of the same nest taken without the slightest regard to the lighting,

WOODCOCK ON ITS NEST.

This photo was made with a premo lens, ray filter, isochromatic plate, exposure forty seconds. Made during heavy shower.

and it is absolutely uninteresting, at any rate from a pictorial point of view. Another thing to be borne in mind is the arranging of the surroundings. It is frequently necessary to remove some of the small branches and leaves that the nest may be seen to better advantage. In doing this the greatest care must be observed. The *cutting* away of much of the surrounding vegetation would leave the nest unprotected. It is therefore advisable to resort to tying back the branches that form the principal obstruction, cutting away only the smaller twigs or leaves. Don't break these twigs, for in doing so you are very apt to shake the nest, and perhaps loosen it from its support. Cutters, such as those used in pruning trees, are best adapted to this use. If a twig has to be cut, darken the white end with some wet earth that it may not show in the photograph, or, better still, arrange a leaf in such a way that the cut-off end may be hidden. Almost every variety of nest requires some special method of treatment, so it will perhaps be best to commence with the ground nests and work up through the most important types.

Ground Nests.— A typical ground nest of the simple form is the woodcock's. Placed, as it usually is, in fairly open wood or swampy land, it offers an easy mark for the photographer. The first thing to do after finding this or any other kind of nest is to

select the most suitable point of view, one that shows the nest to the best advantage and at the same time gives a proper idea of the environment, which is a very important consideration.

Having chosen your point, remove or fasten back the intervening branches. The view of the nest being comparatively unobstructed, place your camera on a very low tripod or even on a pile of stones. The object of this is to avoid the effect of looking directly down on the nest, for that simply shows a *plan* of the nest and eggs, without giving a proper idea of either its form or its position.

In these plan-like photographs of nests it is sometimes difficult to determine whether the nest is in a bush or on the ground. Some people have the idea that in order to obtain a good photograph of a nest all the eggs should be visible, and everything is sacrificed to that end. I have seen deep nests, such as the vireo's or even the Baltimore oriole's, photographed directly from above, so that only the rim of the nest itself was visible. In this way no idea of the exquisite form of the structure was given. It is quite sufficient if about half of the egg shows in the picture. The nearer ground the camera is placed, to within about eight inches, the better will be the effect of ground; but it must be remembered that, in addition to the full use of the swing-back, the lens will have to be stopped down to its limit (i.e., the

YOUNG BLUE JAYS GETTING READY TO LEAVE THEIR NEST.

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smallest diaphragm must be used), otherwise both the immediate foreground and the part a short distance back from the nest will be completely out of focus. The long exposure made necessary by the smallness of the diaphragm is a great drawback if there is much wind or if there are small plants whose leaves and flowers are affected by the slightest movement of the air.

Ground nests situated in fields or any place where vegetation is abundant are less easy to photograph. The best effects are secured on calm days. Direct sunlight is not only unnecessary, but scarcely to be desired, for the reason that the shadows are inclined to be too dark and the eggs will not show their markings. A *bright* cloudy day is the best for nest photography, but if the sun is shining the nest may be screened by means of a piece of thin white muslin. This will allow sufficient light to pass, so that it will be easy to make a brilliant photograph. On no account *under*-expose your plate when the subject is a nest flooded with sunlight. Much more satisfactory results are to be obtained by erring on the side of over-exposure. Those hard black-and-white photographs so often to be found in amateur work are the result of under-exposure, coupled not infrequently with faulty development.

A nest that requires special attention is the exquisite little domed home of the oven-bird. It is not

easy to obtain a really satisfactory photograph of this nest. If we expose for the interior, the exterior suffers, and vice versa. To hit upon the happy medium requires both care and experience. After trying various methods, I have found the most satisfactory thing to do is to throw a ray of sunlight into the nest by means of a mirror. This light should be allowed to enter the nest only during a small part of the time necessary for the exposure. For example, supposing your lens to be cut down to a very small aperture, when the correct exposure would be perhaps forty seconds; then while the lens is open and the exposure taking place, allow the sunlight, reflected from the mirror, to illuminate the interior of the nest from two to six seconds. Too much local illumination destroys the effect of the depth of the nest and is therefore to be avoided. While using the mirror, keep it in constant motion, so that the light will be diffused.

When photographing ground nests in open, windswept fields, it will sometimes be found necessary to place a cloth screen around the nest (far enough away not to interfere with the picture) to protect it from the wind. Otherwise only a very short exposure can be given.

Nests in Bushes and Trees.—Here we come to the most satisfactory nests from a photographic stand-

OVEN-BIRD'S NEST

point. The great variety of the nests themselves and the endless variety of the surroundings offer far greater possibilities than are to be found with the ground nests. All that has been said in regard to sunlight holds good with these nests, a soft, diffused light being in most cases the most effective. When direct sunlight is used it is a good plan to throw up a reflected white light that will soften the under shadows. This may easily be done by taking a yard or two of white muslin and fastening a stick at each end. The sticks should be pointed at one end, so that they may be put into the ground, and the cloth, tightly stretched, will be held at such an angle that the light will reflect from it upon the nest. A white cloth placed on the ground beneath the nest will reflect more or less light, and will in some cases be found to answer the purpose. A difficulty that will be the cause of frequent failures unless precautions are taken is the moving of the nest. This may sound strange, but it is nevertheless a fact that the nest does move, or rather its support moves. Take, for example, a nest built among the small twigs at the outer end of a branch. With the slightest breeze the branch sways slowly but surely, and the nest, which may have been in perfect focus when you looked on the ground glass, has moved several inches one way or the other, and consequently is out of focus. The most obvious way to prevent this is to

fasten the branch by means of strong twine to some stationary object, such as a peg driven in the ground, one of these being used on each side. It is needless to add that these guys should not be included in the picture.

When fastening back branches that would otherwise obstruct the view of the nest, be careful not to alter the natural growing position of a plant or branch. For instance, a branch that is found growing horizontally would look somewhat peculiar if it were portrayed in a vertical position. It is safer to avoid, so far as possible, disturbing the surroundings of a nest; for unless the changes are made with due care and knowledge of how things should be, the picture looks artificial and loses its value as a portrait of a nest *in situ*. It is permissible to introduce flowers into the picture if they serve to give a better idea of the nature of the surroundings. If properly arranged, these flowers add greatly to the beauty of the composition, but all depends on their proper arrangement. A nest may be situated within a few feet of a bush of blossoming huckleberries, and if there is no reason why it should not have been placed nearer, the bush may be transplanted so that part of it will show in the picture.

The same may be said of blackberry-vines, among which birds so often build. A sprig on which there are several flowers, if placed above or beneath

LONG-BILLED MARSH WREN'S NEST.

the nest, adds not only beauty to the photograph, but at the same time shows that the bird nests during the season when that particular flower is in bloom. In adding flowers to the surroundings, the great difficulty is that they wilt so quickly after being cut; so it is advisable not to place them in position until everything is ready for the exposure, and even then it is a good plan to wrap a wet cloth round the ends of the stems. So much may be done in the way of giving accentuation to the local colour: a plant of false hellebore introduced will show that the nest is near a stream or in swampy ground, while wild geranium will show that the nest is in a fairly dry situation. The presence of a dragon-fly near a red-winged blackbird's nest will add to the beauty and interest of the picture, for, as a rule, the nests are found in swampy places, where dragon-flies are abundant. It is not always easy to induce these insects to perch just where one wishes to have them, but it is worth while waiting some time in the hope that one will come. I remember waiting five hours before one perched just where I wanted it.

If the nest to be photographed is in a very low bush within perhaps twelve inches of the ground, the fact may be made apparent by placing a flower, such as a daisy, beneath the bush. The position of the flower will show the approximate height of the nest. These details, though not by any means neces-

sary, are useful, for besides showing, as already stated, the local colour and the time of nesting as made known by the presence of the flower, if coloured lantern-slides are to be made the addition of the spot of bright colour, however small it may be, enhances the beauty of the projected picture more than is generally realised.

For contact prints or even for enlargements the image of the nest should be fairly large, that is to say, it should occupy nearly a third of the plate; but if for lantern-slide use, it is advisable to show more of the surroundings. So for this reason, when photographing a nest, it is a good plan to make at least two negatives, one showing the nest large and one small. Should the nest be a rare one or a kind difficult to find, make several negatives, giving each one a different exposure. By this method the chance of failure is reduced to a minimum. Nothing is so unsatisfactory as to find, after taking a great deal of trouble in making the pictures, that one has failed through over- or under-exposure, and this is likely to happen to any one, experienced or inexperienced. No one, however many photographs he may have made, can say that he is sure of his exposure under the ever-varying conditions that are to be met in the photographing of natural-history subjects. The question of exposure has been treated in Part II of Chapter I, but all that can ever be written on the

one gives up the idea of using them. What, you may ask, is the remedy for these difficulties? The only thing I have found to answer at all is to *thoroughly* clean every leaf by washing it with a soft cloth. It is a task requiring great patience; but once the plant is really clean it will remain so for several days, requiring only to be well rinsed in clear water each time it is used. Betweenwhiles it is, of course, kept in clean water, which should be as near as possible the temperature to which the plant is accustomed. Over-warm water will cause the plant to lose its colour and become covered with scum. Never put any plant or stone, or in fact any accessory, into the aquarium until you have ascertained that it is free from scum and other foreign matter. Stones, especially those that are rough and honeycombed, require to be scrubbed with a hard brush and sand until they are perfectly clean. Sand, if it is necessary to use it, may be cleaned by throwing a little at a time into a bucketful of water. The part that does not immediately sink should be emptied out. This must be repeated until only the clean, heavy sand remains. But even this should not be used unless you have a very quiet fish to photograph. A restless fish will disturb the sand, which in sinking will fall on the fish; so that if he remains still enough to be photographed, he will be covered with a fine deposit of sand, and, needless to say, this will entirely

spoil the picture. Occasionally one finds a fish so well behaved that he will allow the deposit to be swept off, staying quiet the meanwhile. Such fish are *very* rare. A piece of white coral looks so clean that one is tempted to place it in the water without previous washing, and too late we discover our mistake.

Many of the aquatic plants are so light that they float, thereby causing great annoyance. Especially is this true of the grasses. Heavy split shot attached to the ends is a good preventative, but these must be carefully tied if the plant is brittle, as most of them are. Another plan which can be used to good effect with grasses is to take a thin strip of sheet-lead and attach the grass along this at intervals. It saves much time in the end if, before placing the fish in the aquarium, all the accessories are carefully arranged and secured.

In selecting the surroundings to be used, something should be known of the habits of the fish. For instance, trout require stones or rocks, with a little light vegetation, such as grass. Yellow perch need only plants. The bluefish should have no accessories, while the angel- and parrot-fish look more natural if placed among weed-covered rocks and a luxuriant growth of plant life. Any fish that lives on a muddy bottom should either be photographed on the white oilcloth or on sand. But don't be

tempted to use mud, unless you are fortunate enough to find a clay that packs tightly and is not easily disturbed.

Surface fish should always be shown near the surface, for it adds so much to the interest and even the value of a photograph if the fish is seen in surroundings that are natural. In arranging the plants and rocks (the tongs mentioned in the outfit will be found most useful in doing this), place most of them between the glass partition and the back of the aquarium. In this way they will not be disturbed by the movements of the fish. A fish that becomes excited will disarrange everything in a very short time. It is therefore better to have only a few plants between the glasses.

One of the great difficulties met with in fish photography is the moisture which condenses on the surface of the glass. When cold water is used and the day is hot, the glass must be wiped and polished every minute or two; for it is as well to remember that unless the glass is *absolutely clean and dry* a good photograph cannot be made. The slightest mark on the surface of the glass shows with a distinctness that is very discouraging, while the presence of a little moisture makes everything behind it blurred and ill-defined, just as though it were entirely out of focus. It will be seen by this that too much care cannot be taken in keeping the glass in proper con-

dition, and in order to do this avoid using any cloth that leaves lint.

The water-supply is an important factor in fish work. Not only must the water be constantly renewed, but it should be kept at the correct temperature. Few fish will live long in water that varies more than six degrees from that to which they are accustomed. If the change is very gradual they do not appear to feel it so much, but a sudden change is usually fatal. If trout are to be photographed, it is nearly always necessary to use ice, as the temperature should be about 42° or 46° Fahrenheit.

It is well to keep a thermometer in the part of the aquarium where the fish is. With some fish this is not needed, but with delicate cold-water fish it is an absolute necessity.

The easiest way to keep water constantly fresh is to place a pail of fresh water either on the back upper corner of the aquarium or on a convenient place near by. A small rubber tube used as a syphon will allow a steady stream to flow from the pail, while another rubber tube placed in the aquarium, with the end hanging out over the edge, will syphon out an equal amount. In this way the supply will be constantly changing; but even so it is advisable occasionally to aërate the water by pouring some in from a dipper held several feet above the surface.

subject will not show one the actual actinic power of the light at the time of making the exposure. Neither will it show how fast is the plate we are using, for plates, especially the isochromatic, vary greatly in their rapidity.

To go back to our subject. Any nest placed in a bush within four or four and a half feet of the ground is usually an easy subject, but when the distance is greater the difficulties increase. Extension legs to the tripod will be of great help if the nest is not more than six or seven feet from the ground. When higher than that it is usually necessary to attach the camera to a branch. This is done either by means of a ball-and-socket arrangement, such as is used for attaching the camera to a bicycle, or by fastening the tripod to the branches ; the latter, however, is an awkward and troublesome thing to do. In case there is no branch in a suitable position, the difficulty can be overcome by lashing a stout stick, which should be forked at one end, across from branch to branch, and attaching the ball and socket to this. Or if this is not possible, set an upright forked stick into the ground so that the crotch is at the desired height. Then the horizontal pole may be attached to a convenient branch at one end, while the other end rests in the upright crotch, or, if more convenient, two of these forked sticks may be used. In this way, if the camera is above our reach, the difficulty of arranging

and focussing may be overcome by cutting a pair of stilts and using a third stick as a brace. This is not perhaps as easy as it sounds, but if the nest is a rare one it is worth the effort.

Occasionally we find a nest placed at the outer end of a branch that is just out of reach of the camera on its tripod. If the branch is not too thick it can be pulled down until it is within easy photographing distance, and secured by means of a cord. In doing this do not change the angle of the nest. Forcing up the end of the branch by means of a forked stick placed at the thick end of the branch will correct this defect. Do not move the eggs in a nest, but leave them as they are arranged by the bird. We often see pictures of nests completely spoiled through this misplacement of the eggs. It must be remembered that, though birds turn their eggs very frequently, they never leave the small end pointing upward, unless the bird, having been flushed suddenly, accidentally disturbs the eggs on leaving the nest.

Crows' and hawks' nests, and others that are placed at a considerable height, can, as a rule, be photographed only from an adjacent tree. It is not easy work, requiring, as it does, that one should be a good climber and not easily made dizzy. Do not attempt to carry up your camera and other material. Attach a good strong cord, and leave them on the ground in

NEST OF DOWNY WOODPECKER.

A hole was cut in the branch in order to show the position of the eggs.

such a position that they can be hauled up without catching in the branches.

Nests in Holes.—These are the least satisfactory nests to photograph. If we wish to show the eggs that are laid in a hole in a tree, we can do so only by making an opening in the branch or trunk, and this is almost sure to cause the bird to abandon it. There are some few birds, such as the chickadees and occasionally the crested flycatchers, that will not desert their homes even on such provocation, but they are the exception. After the eggs are hatched it is different, but at present we are dealing only with nests containing eggs. One way is to wait until the young have left the nest and then place eggs (from a collection) in the nest, but even this cannot be done satisfactorily except in the case of woodpeckers and other birds that build no nest, but lay their eggs on chips or bare wood. The reason for this is that the nest after the young have left it is quite different from when the eggs were in it. Not only is it changed in shape, but it is strewn with the particles of sheathing cast from the budding feathers of the young birds. If an opening has to be made in a branch, do it with a lock-saw, by cutting out a clean square piece which can be fitted in place again. This answers perfectly when the young have left their eggs, and will sometimes answer when the nest con-

tains only eggs. It is, however, not safe to try it unless there is some special reason why the eggs should be photographed.

With birds that will build in bird-boxes one may obtain photographs of the eggs without much risk. The way to do it is to make the box with a hinged lid which can be opened when the photograph is to be made. The box itself might also be made detachable from its support.

Nests like the kingfishers', that are placed in banks, cannot be photographed except by cutting away the bank, when of course the nest is destroyed. So it is better to leave such nests alone.

Before leaving this branch of photography it would be well to draw attention once more to the fact that most birds will desert their nests upon very slight provocation, especially if the nest is handled. So on no account disarrange either the nest or the surroundings more than is *absolutely* necessary.

Do not make this work an excuse for destroying bird life. Let it, instead, take the place of egg-collecting, when, if properly and conscientiously done, both the birds and ourselves will reap the benefit.

PART II

PHOTOGRAPHING NESTS CONTAINING YOUNG BIRDS

Outfit required.— The same as for Part I, with the exception of the lens, which should be very rapid and have great depth of focus.

More interesting but far less satisfactory is this branch of bird photography. Occasionally we happen to obtain really good results, but take it all in all the pictures of the young birds in their nests, especially the smaller ones, are very disappointing. The reasons are obvious, but difficult to overcome. To begin with, very young birds are in constant motion, and this motion is fairly rapid; when at rest it is due only to the respiration, but when their heads are raised they tremble violently, owing no doubt to the weakness of their muscles. Therefore all photographs should be made with a very short exposure, if sharpness of outline is desired. Of course this means that the lens must be used wide open or nearly so, with the resulting lack of depth of focus. When the young birds are asleep or are resting they huddle together so closely that one cannot be distinguished from the other, and the photograph simply shows a mass that might be almost anything. This applies more particularly to small birds up to the size of the robin. With the larger birds this difficulty is far less noticeable.

In photographing small birds' nests containing very young birds, arrange the camera so that the nest shows in the desired position, and focus on the inside of the near rim. When all is ready and the shutter set to about one fifth or one twenty-fifth of a second, make a noise or tap the branch near the nest, and instantly all the youngsters will raise their heads and open their mouths, ready for food. Usually the slightest vibration near the nest will cause them to do this. While the heads are up is perhaps the most satisfactory time for making the exposure, as it shows the birds in detail. When they lower their heads and before they settle themselves in a mass is also a good time, particularly so if they rest their heads on the edge of the nest. Sunlight is almost essential for these young-bird photographs, but great care must be taken not to have the shadows too dense. Reflecting-cloths should be used as far as possible. Extreme high lights may be avoided by placing a very thin screen of cheese-cloth (wet cheese-cloth is more transparent) or some such material over the nest, but not too close to it.

It will be noticed in instantaneous photographs of birds' nests, especially if they are in surroundings of foliage, that the backgrounds are simply black-and-white blotches. This is difficult to overcome. Perhaps the best way is to hang a light-gray cloth or even white cheese-cloth at a distance of from about

four to eight feet from the nest. The cheese-cloth, being more or less transparent, allows the background to show through to a limited extent, this modifying the white of the cloth. If properly arranged this background gives very pleasing results. Should the nest be in a shaded place it will be found necessary to *bend* back the branches (on no account should they be cut) in order to allow the sunlight to strike the nest, but do not on any account destroy these shading leaves, as the young birds cannot endure the direct rays of the sun; you may notice that in almost every case the nest is situated so that it is protected from the sun during the greater part of the day. In photographing the young in their nest do not let the sun shine on them until you have everything in readiness for making the exposure. When there is not sufficient light, the sun's rays reflected from a mirror will be of great assistance, though the birds will be illuminated to the exclusion of the surroundings. The mirror will also prove most useful in photographing young oven-birds and others whose nests are screened from the sunlight by overhanging roots or branches. Backgrounds in shadow are not desirable, as, with the shortness of exposure, they show almost black in the photograph. Cutting down the branch in which a nest is built is not to be commended. It is sometimes done in order that the nest may be placed amid properly

lighted surroundings. But this is done at the risk of the lives of the young birds; not that the parents will often desert a nest once the young are hatched, but if the branch is cut, the leaves die, and hanging dead and shrivelled, they are conspicuous, with the result that attention is drawn to the nest and its contents.

Then again, when the surrounding leaves are dead, unless very carefully replaced, the nest is exposed to both sun and rain, and, as a result of the more or less constant sunlight, the young are made restless and desert their nest much sooner than they otherwise would. In fact, I believe that young birds seldom stay as long in a nest that has been discovered and handled by human beings as they do in one that has remained undiscovered. This may be a wrong idea, but I have seen much evidence that goes to prove it. It is an indisputable fact that the longer a young bird remains in its nest (I speak only of those whose habit it is to remain in their home until they are about ready to fly), that is to say, the more developed it is, the better is it fitted to withstand rain and to elude its only too numerous enemies. Probably only a small percentage of the birds that leave their nest ever reach maturity, so it is highly advisable to do all in our power to lessen their dangers rather than increase them by changing their surroundings and forcing them out into the world of enemies before

YOUNG CROWS IN NEST.

they are ready. Once a young bird has left or been removed from its nest, unless it is very young, it will seldom consent to remain in it again. This applies in particular to birds that nest on the ground, less so to those that build in bushes, and least of all to those which, like the woodpeckers and chickadees, build in holes in trees. The latter seem only too glad to be put back in their nest.

There is a marked difference in the length of time that young birds remain in their nests. Taking for example the smaller varieties, we find that, as a rule, those whose nests are on the ground not only leave at a very early age, but before they are able to use their wings. Young field-sparrows, blue-winged warblers, and oven-birds may be found creeping mouse-like among the grass and leaves in a very undeveloped state, unable to fly even a few feet, and scarcely able to balance themselves on a twig.

Birds whose nests are in bushes or trees remain in their nests until they are fairly well developed, usually not attempting to leave until their wings are more or less completely feathered, so that they are able to fly a few yards. But the birds hatched in a hollow branch develop rather more slowly and remain in the nest until they are almost as large as their parents and are fully feathered. Certain young birds, such as the screech-owls, use the nest as a home, leaving it at night, when they venture along the branches to receive

their feed of June-bugs and other such insects which their parents bring to them, and returning home for the day.

The larger the bird the more satisfactory will be the picture of the young in their nest, for the reason that not only are they more clearly defined, but the camera must of necessity be placed at a greater distance from the nest, thereby giving a greater depth of focus, for of course the nearer the object, the less is the depth of focus of the lens. On this account it is better not to make the image larger than necessary, but rather to rely on enlarging the plate.

It is well to remember that when fledgelings are within a day or so of leaving their nest any imprudent act on your part may precipitate their departure. Therefore avoid shaking the nest or handling the young. Sometimes if even their heads are gently moved they will all scramble out, after which they can seldom be induced to occupy their nest again.

PART III

PHOTOGRAPHING THE NEST WITH THE SITTING BIRD

Outfit same as Part II, with addition of a telephoto lens and a long rubber tube with large bulb or hand bicycle-pump for releasing shutter.

Now we begin to realise the marked individuality of birds and to learn how this individuality affects our

work. If the bird photographer commenced this branch of the art by attempting to portray a yellow-breasted chat or a crow on her nest, he might, were he not of a very persevering nature, give up for ever any hope of success. And, on the other hand, should he choose for his first experiment a bird such as the wood-thrush, he would underestimate the difficulties and have an entirely wrong idea of bird-on-the-nest photography. The actual photographing of the sitting bird is in itself a most easy task *if* the bird is willing, but how much depends on that if will be readily appreciated by the time one has made two or three attempts to secure such pictures. The first thing to do in order to insure success is to become friends with the bird; let her become accustomed to your presence, then gradually introduce the camera, first placing it at some distance from the nest, then gradually bringing it nearer. The chances of success are far greater during the first few days after the young are hatched than when there are only eggs; for, as you well know, a bird will often abandon her eggs upon very small provocation, while she will seldom leave the young so long as they are alive and need her help. When the young are very small they need constant feeding and watching, and should the day be cold or damp the mother's warmth will be an absolute necessity. Relying on this, I would recommend such a day as affording the best opportunities

for the work, *but* should the parent bird show such fear of the camera that she will remain away from her young more than a safe time, remove the camera rather than risk the lives of the fledgelings. It occasionally happens that when the nest is first discovered and the bird is sitting she will allow herself to be photographed without *displaying* fear, or, what would perhaps be more truthful, she remains on the nest either because she believes herself unseen or because she is afraid to move. To take advantage of this, great care must be observed. Not only must no sudden movement or noise be made, but the camera should be assembled at some distance from the nest, yet within sight of it, and then gradually brought nearer and nearer. The first exposure might be made while at some distance, in order to be sure of at least one photograph. This precaution is advisable because one can never tell exactly how near the bird will allow the camera to be placed. Having secured one picture, try another at a few feet nearer, and so on until either you are within the desired distance or the bird has flown.

The subject of exposure is one that requires a few words. Almost always people make the mistake of under-exposing, believing that because the bird is alive nothing but an instantaneous exposure can possibly secure a sharp picture. Such an idea is usually a mistake. As a rule, a bird on her nest remains absolutely still for seconds at a time, thereby allowing of a time

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WOOD-THRUSH ON ITS NEST.

Exposure about four seconds with single combination of Goertz lens.

exposure. I have given as much as sixty seconds, but of course this was an exceptional case, and indeed such an exposure is very seldom needed. Should the bird be restless, moving her head all the time (they usually follow your every motion with their eyes), you may attract her attention as you are about to make the exposure by holding something conspicuous, such as a handkerchief, in one position, and nine times out of ten she will watch it intently for several seconds, thus affording the desired opportunity.

As birds vary so greatly in their manner of manifesting fear or distrust of man, each one may be said to be a separate study and calls for a special method of treatment. Some will allow a person to come to within two or three feet of the nest without leaving, and yet will not remain if the camera is anywhere near them. Others show no fear of the camera, but distrust the man; while others again, and these are the kind we want, allow both man and camera to come within a very short distance. Sometimes it is necessary to place the camera in readiness while the bird is absent and wait at a distance for her return, and even then the exposure may have to be made with the aid of a long rubber tube. An extreme case of this kind I experienced when once I tried to photograph a Wilson's thrush on her nest. After trying various methods without success I placed the camera about ten feet from the nest and partly con-

cealed it with branches. Then I attached fifty feet of rubber tubing to the shutter and retreated to that distance from the nest. After waiting for about half an hour I crawled very quietly toward the nest, but before coming within sight of it, I heard the bird leave. Once more I retreated, and after waiting another half-hour decided to press the bulb, making the exposure on the chance of the bird being on the nest. Whether she was I do not know, but I made several chance exposures during the day, and when I developed the plates there were many good pictures of the nest, but only one showed the sitting bird.

For photographs of birds on their nests, the lens used should have great length of focus, not much less than twelve inches. The single combination of almost any of the newer makes of convertible lenses gives excellent results. The object in using a long-focus lens is not only that a large image may be obtained while the camera is at a considerable distance from the bird, but because the noise made by releasing the shutter frequently causes the bird to start, and of course the farther away the camera is the less will be the chance of her hearing the noise. The photographing of the sitting bird offers the very best opportunity for the use of the telephoto lens, but still it is better to use a good long-focus lens where the bird is fairly tame, resorting to the tele-

photo only when it is not possible to get as near as would be otherwise necessary.

Some birds, such as the yellow-breasted chats, I have never been able to photograph sitting on or near their nests, though I have wasted many hours in the attempt. With red-winged blackbirds I have had the same experience, and though this does not prove that they cannot be photographed, it shows that they are on the average far less tame than the wood-thrush, the blue-winged warbler, and some others with which I have had nothing but good luck. The main thing, therefore, if you wish to be always successful in photographing birds on their nests, is to find birds that are tame. Having found them, use a long-focus lens, give sufficient exposure, and you will be sure of success.

PART IV

PHOTOGRAPHING NESTS WITH OLD BIRDS AND THEIR YOUNG

Outfit same as Part III.

FROM photographing the parent bird sitting peacefully on her nest to the task of portraying the same bird standing nervously on the edge of the nest or on a near-by twig, while the young hold up their unsteady heads in anticipation of a meal, is but a step on the photographic ladder; it is a difficult step, however, for the obstacles are many and not over-easily mas-

tered. Apart from what we might term the natural difficulties, such as the stalking of the bird and getting the camera within suitable range, there is the question of light, for usually instantaneous exposures are necessary. Now we all know that most birds build their nests in shaded places, places chosen without the slightest regard to the needs of the bird photographer, and in these shaded places an instantaneous photograph is practically an impossibility. Then there is another difficulty, one even more serious: In close-range work the depth of focus of an open lens is very slight. Objects to be in sharp focus at a distance of a few feet must be nearly on one plane; three or four inches one way or another will make a very great difference in the definition. Now suppose you focus the lens on the near edge of the nest, so as to secure a sharp picture of the young birds when they raise their heads; then the mother bird comes and perches either on the farther edge of the nest or on a twig several inches beyond. Under such conditions you may not stop down your lens in order to increase its depth of focus, owing to the lack of light, so you have to sacrifice the sharpness of either the old bird or the young. The method adopted by some bird photographers is to insure the correct lighting by removing the nest from its natural position and placing it where conditions are favourable for photographing. This method is not to be

recommended, as, unless done by an extremely conscientious person, one willing to guard the nest and its contents against risk even at great personal inconvenience, the resulting loss of bird life would be very great and quite uselessly so. Birds place their nests where the surrounding vegetation will shade the young from the direct rays of the sun, and should these shading leaves be removed, or should the nest be taken away from them, the young birds, in their anxiety to avoid the sun, will frequently scramble out of their nest long before they are fledged, and death is an almost certain sequel. Even by disturbing the surroundings of a nest there is danger to the young birds, as the nest is no longer so well concealed and is therefore more or less exposed to the many natural enemies that during the nesting season are ever on the hunt for young birds and eggs.

To any one who has not had experience with birds, it would seem an easy matter to coax the parent bird to the nest when the young are there to act as a lure. The camera, one imagines, would be utterly disregarded. But such does not happen to be the case, that is to say, it is not the rule. Certain birds, such as the yellow-breasted chat or the crow, cannot, according to my own experience, be enticed to the nest, and I fully believe that the crow would allow its young to die of starvation rather than visit the nest while the camera is anywhere near. Many birds,

such as the blue-winged warbler, the wood-thrush, the chickadee, and others, display very little fear of either the camera or the man when their young need attention, so for this reason they are the most suitable subjects to practise on. If the birds happen to be tame enough, it is an excellent plan to use a white reflecting-cloth, throwing the light upward from it in order that the otherwise dark shadows shall be softened. A background cloth may also be used with advantage, provided it does not frighten the bird. This cloth should be white or gray, and of sufficient size to allow of its being placed not less than six or eight feet back of the nest, the farther the better, as the distance gives a soft effect in the photographs, making the bird and nest stand out fairly well defined against the indistinct grayish background. Any shadows thrown on the cloth are rather an advantage than otherwise, unless the cloth is near the nest, in which case they appear too well defined. In cases where the birds are very shy it is necessary to resort to some method of concealment for the camera and one's self. Perhaps the best device is an artificial tree-trunk, made of very light material such as muslin or even cheese-cloth. This is stretched over large hoops, which may be made of cane or strong wire, the former by preference, as it is more easily attached. Three uprights should be made of strong, stiff cane jointed in the middle with ferrules such as those used

WORM-EATING WARBLER AND YOUNG.

Illustrating the tameness of a comparatively rare bird.

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for fishing-rods. The whole structure ought to be not less than six feet six inches in height and large enough to allow of the camera being worked conveniently. The cloth should be painted to imitate a tree-trunk, and to carry out the illusion strips of bark might be attached by means of small wire hooks. Creeping plants, such as vines of different kinds, will add greatly to the realistic effect. Be sure to have ample openings for air at the base and let the top be open, otherwise the heat will be unbearable. A branch thrown over the top opening will be sufficient to conceal you from the bird's view. Several openings at different heights will have to be made through which the lens may protrude. When possible, it is as well to place this tree-trunk in position overnight or at least several hours before entering it, thereby avoiding the otherwise long wait, which will be found extremely trying, especially during hot weather, for the heat of these tree-trunks is their greatest objection. The use of any method of concealment aids one in securing photographs of birds, but at the same time it takes away a great deal of the excitement that is to be found in trying to make friends with the bird. Therein lies the principal part of the pleasure of this branch of photography: it takes one close to the bird during the most interesting period of its life, and one has the opportunity of studying the bird's habits to greater advantage than at any other time. The actual diffi-

culties to be met with in photographing the parent birds with their young in the nests are not quite so great as when the young have left their nest. To this branch of the work we will devote the following pages.

PART V

PHOTOGRAPHING OLD BIRDS AND THEIR YOUNG AFTER THEY LEAVE THE NEST

Outfit same as Part III.

PHOTOGRAPHING bird families after they have once left their nests we count the most delightful part of bird photography, the one which has the greatest possibilities and perhaps the greatest amount of difficulties to be overcome; that is to say, if we do it openly, without making use of any method of concealment. By doing it openly we come in personal contact with the birds, and we learn that they are not so wild as generally supposed. If they see that no harm befalls their young through our presence, they will frequently lose all fear and perch on our hands and shoulders. This is, of course, true only of certain birds. Of those that I have tried to induce to come to me, I have had the greatest success with blue-winged warblers, worm-eating warblers, chickadees, and chipping sparrows. In every instance they have shown an utter fearlessness and have come to me even

BLUE-WINGED WARBLER AND HER YOUNG.

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CHIPPING SPARROW FEEDING ITS YOUNG.

though I happened to be moving. With some other birds I have had more or less success, and with others, such as the chewinks, red-winged blackbirds, and yellow-breasted chats, I have so far had nothing but failure.

In order to secure young birds at the time they are ready to leave their nest, it is necessary to watch them carefully, remembering that the young of different birds leave the nest at very different stages of development. For example, young grouse, quail, and woodcock leave almost immediately after coming from the eggs, just as a chicken does. Ground-birds, such as field-sparrows, bobolinks, etc., usually leave before they can fly at all, some starting off when but eight days old. Birds whose nests are at some distance from the ground seldom leave until their wings are fairly well developed; for the smaller birds the age is about twelve days. Chickadees and woodpeckers and others whose nests are in holes in trees are well developed at the time of leaving. So it will be seen that in order to know when to expect the young to leave you must know something of the bird and its habits. It is also well to remember what has already been said, that if you attempt to remove a young bird from its nest when it is within a day or two of being ready to leave, it will often refuse to go back even though it is not sufficiently developed to risk itself away from its home. It is very doubtful whether such birds often survive.

Occasionally one comes across young birds that are only just able to fly, hiding in the scrub. These, if not too far advanced, are splendid subjects for the camera, *but* they are not very easy to find. In fact, it is seldom that more than two of the brood can be found. So it is best to rely on watching a nest, spending some time near it in order that the old birds may become used to your presence.

When the young are about ready to leave, make all your arrangements before disturbing them. Select the support you wish; a growing branch on which there are not too many leaves is best, and to confine the range of both old and young birds it is well to isolate the branch by cutting away the immediate surroundings, otherwise the young will hop about from twig to twig and so get outside the field of your camera. Be sure when focussing on the support to leave sufficient space for the old bird on either side of the young. If the branch is inclined to sway with the breeze, secure it firmly, or it will swing backward or forward and be out of focus. Do not forget that the weight of the birds will cause the branch to sag downward, so allow for this when placing the camera. On the choice of the background much depends. A light background is far the best, as a dark one, being of course out of focus, comes out much darker than you might expect. A cloth background, as suggested in Part IV, can be

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WORM-EATING WARBLER FAMILY.

used to advantage, provided it does not frighten the bird, and my own experience leads me to think that the birds pay but little attention to it. The same may be said of the white reflecting-cloth placed beneath the birds. It is scarcely advisable to use much in the way of accessories, as, owing to the shortness of exposure, the lens must be used open or nearly so, and the leaves or flowers which extend a few inches forward or back of the birds would be completely out of focus and would simply be black and white blurs which would add nothing to the beauty of the picture; rather would they detract from it. In taking the fledgelings from the nest be careful not to let them escape, for their powers of hiding are wonderful. Let them once scramble into the scrub and it may take you hours to find them again. The most certain way is to put them into a bag (which should have breathing-holes cut in it), then one by one they can be taken out and placed on the branch. This sounds easy, and occasionally it is so, but as a rule the young rascals will not do anything you wish; sometimes, even though they are strong enough, they will not stand on the twig; they will fall backward or forward, as though their legs were paralysed, or they will clutch hold of their neck or wings and absolutely refuse to make proper use of their feet. It is a good test of patience, but you will soon realise that only by keeping good-

tempered and cool can anything be accomplished. Just keep on putting each birdling in place, no matter how often they fall off, and after a while, and it may take a long time, they will lose their obstinacy and behave themselves as young birds should.

If you find that they insist on flying away, even though they can go but four or five feet, tire them out by forcing them to take a number of such flights in quick succession. They will soon be only too glad to sit quietly. Do not on any account attempt to feed very young birds with worms or other insects or fruits. Leave that to the parents; they know far better than you what suits a fledgeling's stomach. If the day is very hot it is better not to subject the youngsters to the direct rays of the sun for longer than is necessary, as they cannot stand too much heat.

Now we will consider that all the young ones are sitting quietly on the branch and you have your camera in readiness. The next step is to induce the mother bird to come. For your success in doing this, patience is very necessary, but by far the most important consideration is the bird's disposition. Should she be naturally tame, your troubles will be few; but if after waiting for six hours or so she still refuses to bring food for her young, your trouble will, in all probability, have been in vain, and you will have to search for a new subject. I once spent two entire days trying to coax a chewink to come

INDIGO BIRD ABOUT TO FEED HER YOUNG.

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INDIGO BIRD FEEDING HER YOUNG.

and find her young who were posing before the camera, but without success. (Needless to say, I allowed them opportunities for feeding by removing the camera occasionally.) Even though I concealed the camera with leaves, and while I went forty feet away and hid in the bushes, one or other of the old birds would sit close by and watch every movement. Several times I saw one of the birds go fairly near the young (without carrying food), and my hopes would be raised, for I thought the other bird had gone in search of food, when suddenly from the young chestnut-trees which sheltered me a voice would call "Chewink, chewink, chewink," and I knew that I was still being watched. Finally, becoming disgusted and fearing lest the young might suffer for want of food, I packed up my things and went away, marvelling at the remarkable patience of that pair of chewinks.

Birds differ so much in their natures that no rule that will insure success can be laid down. With some birds it is necessary to conceal yourself from view and make the exposure from a considerable distance, but usually you may stand in plain view, provided you are not too near and do not make any quick motions. Once the bird has become used to your presence she will no longer object to your being near; in fact, she will allow you to stand alongside of her young while she feeds them. It is noticeable

that it is usually the female bird who feeds her young in the presence of possible danger; often the male does so as well, but never in my experience have I seen the male bird come until his mate has led the way. With some kinds of birds we find that the male acts as sentinel and does nothing toward the support of the family, while with others the two share all the work together, nest-building, incubating, and feeding the young.

PART VI

PHOTOGRAPHING YOUNG BIRDS ALONE, BOTH WILD AND TAME

Outfit same as Part III, with the addition of a cage-like enclosure of some sort.

In this branch of work we find the greatest possibilities of making beautiful pictures, as the subject is, or should be, under control so that we may arrange our lighting to suit ourselves, and as there is no longer the necessity for the objectionable instantaneous exposure, we can use strong contrasts in the lighting that would be impossible with a very short exposure. One of the most effective arrangements of light, particularly for young birds that are fluffy, is where the light comes from above and back of the bird. For this sunlight is used, softened slightly by passing through wet cheese-cloth or muslin. In this way, if the bird faces you, its breast is in shadow, while the

FIELD-SPARROW FEEDING ITS YOUNG.

sides are brightly lighted and in strong relief. The background should be moderately dark, but not black. A perfectly black background is never artistic (if you will pardon the word) and only crudely effective. Publishers like it because it gives what they term "colour" to the pages, but nothing can be harder on a delicately lighted subject, full of soft grays, than to force it to stand out with painful garishness from a dead black ground. All gradations of contrasts may be obtained by the use of white reflecting-cloths, or to a more limited extent by regulating the exposure or the developer, remembering that an under-exposed plate will give increased contrast, but that the same effect may be obtained by adding bromide of potash to the developer or by reducing the amount of alkali.

On the selection of the support much of the beauty of the picture depends. A single small twig without leaves has the advantage of making the bird the only object in the picture. This has many arguments in its favour, but still much can be done by choosing a suitable support, such as a small branch with leaves and perhaps flowers or fruit, to give additional interest and beauty to the picture. Using such accessories adds somewhat to one's difficulties, if the branch is cut, as the leaves fade quickly, especially in warm weather, and, needless to say, it is necessary to take precautions against this either by having the end of

the branch in water or by wrapping a wet cloth around it. For the sake of accuracy, arrange the branch so that it will be in its natural growing position; that is to say, a branch that is found growing nearly horizontally should be placed in about the same position, otherwise the leaves will not hang correctly. In the matter of background, an artificial one of any desired tone may be used or a natural one of leaves, scrub, etc., will answer, but the former gives the more satisfactory results, especially if the cloth or whatever is used is hung at a fair distance so that a branch or two may be placed between the bird and the background; this if properly arranged will give the effect of natural surroundings better than any other method.

If the bird or birds to be photographed are unable to fly, it will be unnecessary to have any sort of enclosure; but should they have the use of their wings, an enclosure of some sort will be required, otherwise you and your subject will part company. The making of the enclosure is one of the things that will allow of ample discussion. There are many ideas on the subject, and most of the ideas are conspicuous more by their bad than their good points. Some people advise using a studio which is strongly lighted. Apart from the objection that few can afford such a luxury, the advisability of using it may be questioned. Young birds are tender creatures, easily injured and

THREE YOUNG BALTIMORE ORIOLES AND YOUNG CATBIRD.

Illustrating an effective method of lighting; using back light and front reflecting cloth.

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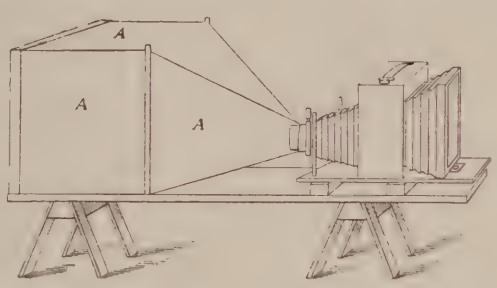
easily frightened. When frightened they will fly about as though crazy, and coming in contact with hard objects are more than apt to injure or kill themselves. A tent made of gauze is not a bad thing. It is portable, easily erected, and is light and airy. Its chief objectionable features are that the birds catch their feet in the fine meshes, and in their excitement they sometimes break their legs; also that if there is much wind the sides bulge in and break away from the ground fastenings. Remember a bird is very quick to discover any hole through which escape is possible, and the rapidity with which it can take advantage of such a discovery is really remarkable. A device with which I have had some slight success is shown in the accompanying cut. It is easily made and answers well for certain work. *A* is mosquito netting stretched tightly to four uprights. The front part is cone shaped, having a rubber band to go over the lens at the opening. The loose bag-like form is to allow of the camera being moved back and forth. An opening large enough to admit a bird should be made on one side. The whole thing is a sort of photography cage which restricts the bird's range, and as it may be placed in any direction, it allows of an almost endless variety of



lighting. The objection to this device (and there is an objection to every device that I have seen) is that for some reason or other it frightens the bird, which usually flies immediately toward the lens and objects to being replaced in its proper compartment. Then, too, it is difficult to handle the bird with any degree of comfort and convenience. It is a curious fact that young birds brought up in captivity are usually wilder and more difficult to manage than those taken in their wild state. This sounds strange and may not be the experience of others, but I have photographed a great many birds both wild and in captivity, and I can safely say that the greatest amount of trouble was caused by the tame birds. A bluebird that I had for several years (he now has a mate and a nest near our house) was what might be termed absolutely tame; he would sleep inside my partly closed hand, come when called, and in all ways but one would show complete confidence. The one exception was when the camera was in evidence. Then and only then would he become bad and act wilder than the wildest bird of the woods, and though I made repeated attempts I never succeeded in making a good photograph of him after he attained his full growth and plumage.

Young birds taken directly from the woods when they are just able to fly are, as a rule, fairly easy to manage. It is true that they sometimes "cut up" a little to

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THREE YOUNG BALTIMORE ORIOLES.

Illustrating the advantage of effective lighting where the bird is young and has fluff-like feathers.

begin with, but with patience and careful handling good photographs can usually be secured without very much waste of time. A good photograph of a young bird is not necessarily a pretty or pleasing picture, for it is in the power of the bird, be he old or young, to appear pretty or the reverse according to his mood. When the feathers are laid tightly down and the bird is stretched out thin, he shows fear and is looking his very worst. With young birds this is particularly noticeable. The same bird can in a moment change from a lean, scrawny, scared-looking atom to a fluffy little ball of soft feathers, a pleasure to look on and a pleasure to photograph. I only refer to this peculiarity of birds in order that the reader may not be in too great a hurry to "press the button." Let him wait until the bird assumes a pleasing attitude, until he "looks pleasant." The results will surely justify the delay.

An interesting feature of bird photography is the portrayal of the growth of an individual. Take for example a young robin the day it leaves the egg. Photograph it as soon as possible, then each day repeat the operation until the time comes for the bird to leave its nest. This series will be most interesting, more especially so if several different types of birds are treated in the same way and careful notes made of the dates. It is unnecessary here to enter into details as to how much interesting material may

be collected in this way. The reader, if a bird student, will readily realise that.

A word as to the method which should be employed in making these series: Each photograph of a set should be made with *exactly* the same distance between the lens and the object; this will insure accuracy as to the size of the bird during each step of its development. Another way is to place the bird on a piece of paper or wood marked off in small squares of equal size; by these squares the bird may be measured. On account of the constant movement of very young birds, caused by their breathing, it is necessary to make the exposure as short as possible. As the birds develop, their respiration becomes slower and less laboured, consequently the exposure may be increased. It will be noticed that the gallinaceous birds, even when but a day or two old, breathe with less apparent effort than the helpless young of the thrushes, warblers, and others that are born blind and naked; their whole body throbs at each breath. Especially is this noticeable when the weather is warm.

On no account should birds be handled more than is absolutely necessary. If they are very young the soft pin-feathers are easily injured, and if they are feathered the warmth of the hand will moisten and disarrange the feathers. When carrying a bird, if it is able to perch, let it sit on your finger (they

YOUNG BLUEBIRD.

YOUNG CATBIRD.

Showing effective lighting when the subject is dark.

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will usually do so after a few attempts), unless it can fly, when of course it must be covered; but if it is unable to perch, place it in your hat (a lining of a few leaves will be a desirable precaution) or some similar receptacle, but on no account carry it for any length of time in your hand.

Before finishing these lines on young-bird photography a few words may not be amiss in regard to the advisability of always, if you use accessories, choosing such as are in keeping with the bird's natural environments. Try to make the surroundings tell of the bird's nature and habits. For example, a scrub-loving bird, like the Maryland yellowthroat, should be among some scrubby growth of a damp-soil nature by preference. An oven-bird would be better on the leafy ground or on a log rather than on a bush. The robin might be placed on a branch, a meadow-lark on a grassy sod, and so on. I once saw a photograph of a family of barn-swallows perched on a vine. The picture was good enough from a photographic and pictorial standpoint, but it lacked interest from the bird student's point of view. If you have many birds together, arrange them so that they will show in different positions, back, front, and side views. It is in all these small details that the difference is shown between the careful and the casual photographer of birds. If a picture is worth taking, it is worth taking as well as one knows how.

PART VII

PHOTOGRAPHING THE ADULT BIRD, WILD AND TAME

Outfit required. — Same as Part III, with addition of a graflex or some such camera, and a telephoto lens; use the focal plane instead of lens shutter if birds in flight are to be portrayed. Reflecting-cloth, pruners, and lock-saw will probably not be needed.

The most difficult and most discouraging branch of photography is that which deals with the wild adult bird at any other than the nesting period. Seldom do we find a bird in its free state that will allow us to approach to within the desired distance. Unless we use a telephoto lens we must be within five or six feet of any of the smaller birds, if we wish the bird to be an appreciable size. At ten feet a robin is a very small object when seen through a lens of nine-inch focus, and yet it is not often that we have the opportunity of making an exposure at even that distance, while larger birds are still more difficult to approach, in proportion to their size. There are times, as, for example, when the ground is covered with snow, when through the scarcity of food birds will allow of a near approach. Photographs can then be made with good results and with comparatively little difficulty. The white of the snow reflects so much light that very short exposures may be made, and the lack of strong colouring and usually the absence of dark shadows are all to the advantage of the pho-

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YOUNG CRESTED FLYCATCHERS.

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YOUNG CRESTED FLYCATCHERS READY FOR FOOD.

grapher. Decoys in the form of food will attract many kinds of birds, and some will become regular visitors where food is habitually placed and will gradually become very tame. A piece of meat or suet secured to a branch will tempt some species, while bread-crumbs or seed thrown on the ground will attract others. Still another good bait is a cocoa-nut, broken in half and hung in a convenient place.

Some birds may at times be coaxed to a convenient site for photographing by the presence of a mounted owl, but this plan works best during the nesting season. A scheme which I have long intended to try, and which might perhaps work successfully, is a portable blind in the form of an artificial cow. This should be made of a light framework of cane or split bamboo and covered with thin muslin painted in imitation of the animal. Of course it must be made light enough to be readily portable. It would be interesting to see how crude an imitation of an animal would pass the critical eye of birds. The photographing would have to be done by means of a graflex or some such camera, as, of course, a tripod would be out of the question. Whether or not this idea would work out cannot be known until it has been tried. I simply offer it as a suggestion. A device used by Mr. Frank Chapman, which works satisfactorily, is an umbrella of a greenish-drab colour. From the rib ends a cloth of the

same colour is hung; this, reaching the ground, completely conceals the photographer and allows him to approach the bird unobserved.

It is unfortunate that the telephoto lens has not the speed necessary for all kinds of bird photography; if it had, our difficulties would be greatly lessened, but except under unusually favourable conditions it cannot be used with any great success. While a bird is on the move or is flying, with the sky for a background, good results may be obtained, provided the magnification is not too great. From my experience 4 diameters is about the limit for instantaneous exposures when the positive element is a very rapid lens. Where birds are among trees or bushes the telephoto is not so satisfactory. The increased exposure made necessary by the scarcity and greenness of the light practically prevents the photographing of such a quick-moving object as a bird. There are exceptions, of course, as, for example, the whippoorwill, or even the ruffed grouse, which will occasionally sit motionless for the required time; but the smaller birds are ever on the move, so that even out in the open it requires a rapid lens and good light to insure a sharply defined photograph that shows any amount of detail. In places where water-fowl abound, as, for instance, in Florida, the possibilities are almost unlimited; owing to the brilliancy of the light, even during the winter months, the telephoto lens may be

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YOUNG FLICKERS.

The white tips of the bills show where the hardening is taking place.

used with the greatest possible advantage. Ducks of many species can be photographed if a blind of grass and bushes is made in a convenient situation. It is best to select a place that is frequented by the birds either for the purpose of feeding or resting. In certain pools, or bends in a river, the birds will be seen nearly every day at certain hours. In such places photographs may be secured with scarcely any difficulty. Of all the places I have seen, Florida is the country *par excellence* for the photographer of water-fowl. The numerous rivers, the secluded cypress ponds, the open marshes, or the sea-coast, all offer facilities for the work that are perhaps unexcelled in any other State. The birds are very plentiful and remarkably tame, except in places where fiends in the guise of men spend their time on the bows of the river steamers, armed to the teeth with shot-gun and rifle, firing at every form of living creature (except men and cattle) that comes within the range of gun or rifle. Their prey may be killed or wounded, it makes no difference; it is left where it falls, and no one is any better for the murderous deed. In this way some of the very best locations, such as the Kissimmee River, are being completely denuded of their bird population, or else the comparatively few birds that remain have become so afraid of man that a near approach is almost impossible. If this crying evil were suppressed, this river and many other such places would

once more be the paradise for the bird photographer and the bird lover. Twelve years ago one could sit all day on the edge of some cypress pond and watch a steady stream of birds — herons, egrets, curlew, wood-ibis, coots, gallinules, and ducks of many kinds — come and go. All day long, from the waking of birds at the first glimpse of dawn till after the sun had set, one's interest need never wane. The bird life could be studied and photographed at will. Animals, too, were seldom wanting: fox-squirrels playing in the cypress-trees; otters, sometimes five or six at a time, would perform their antics with all the playfulness of kittens; 'possums and raccoons and frequently deer would add interest to the scene. Now, thanks to the plume-hunter, the trapper, and the indiscriminate "sportsman" (so called), all this has changed, and one must search for such ponds in places unfrequented by the above-named trio.

In photographing ducks, decoys will be found most useful, as they will entice the wild birds to the place desired by the photographer. But for most of the other birds inhabiting ponds and swamps, blinds and still-hunting are the best methods. In still-hunting one may sometimes facilitate the work by making a shield of tall grass or brush, with the upper part slightly overhanging. There should be an opening of sufficient size, so that the exposure can be made without disclosing one's self. This screen, being

YOUNG RED-EYED VIREO THE DAY AFTER LEAVING THE NEST.

This illustrates the disadvantage of a partly shaded background of leaves.

IMMATURE BLUEBIRD.

Illustrating the ordinary method of lighting.

carried *very slowly*, will often allow the photographer to approach to within fair distance of even the wilder birds. At almost any of the villages situated on the water many species of birds may be photographed, thanks to the local law which prohibits the shooting of birds within "city limits." How well the birds understand this law is made apparent by their remarkable tameness within these prescribed limits. They realise thoroughly that the place is a sanctuary, and that there, at least, men may be trusted, and the man armed with the camera taking advantage of these conditions can secure with ease photographs that would otherwise be practically unobtainable.

In regard to photographing the smaller species of birds, so much depends on the conditions, which are endless in their variety, that it is impossible to cover the subject. Each individual bird is a study by itself, so that no rules can be laid down that would be of much use.

In photographing adult birds in captivity, the same devices may be used as recommended in Part VI; the same suggestions as to lighting and exposure also apply. When a bird is placed in any sort of cage adapted to photographing, do not be in too great a hurry to make the exposure; usually the bird will at first be very wild and excited, therefore it is best to wait until the excitement has passed. Interest the bird in some way, as by giving him something

to eat. Choose something that he likes but is not accustomed to. With insectivorous birds that are in captivity, a grasshopper will sometimes attract attention; while with fruit-eating birds, a bunch of grapes, wild cherries, or other such delicacy will frequently cause them to forget the strangeness of the situation. In nearly all cases where a large image of the bird is wanted, use isochromatic plates; as these render the colour-values so much more correctly than the ordinary plates, it will be patent to the most casual observer how much more correct will be the resulting portrait of the bird. Only in cases where gray and brown toned birds are to be photographed should ordinary plates be used.

Picturing birds in flight is perhaps one of the most fascinating branches of the work; there is something so delightful in catching a bird as it skims past, and securing it for ever on the photographic plate. A few years ago such a thing was impossible, and we had to content ourselves with drawings of the flying bird; and, as the camera has since proved, these drawings were in most cases absolutely incorrect. The position of the wing-feathers when in motion was almost unknown until the camera showed it to us. Now nearly every one has seen such excellent photographs as those made by Mr. Otto von Bargen, which show gulls and other birds on the wing. In order to secure such photographs it is of course ne-

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RED POLL.

An example of photography on the snow.

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RED POLL.

cessary to use a very rapid shutter, the best type being the focal plane, which works directly in front of the plate. With this shutter practically no light is lost, so that with the minimum exposure you secure the greatest possible amount of illumination. Exposures of up to one thousandth of a second may thus be given when conditions are favourable. Needless to say, a camera of the graflex type is by far the best for such work, as it enables one to focus on the bird up to the instant of making the exposure. By this means a sharply defined photograph is almost a certainty, if the shutter is set at the required speed.

In order to secure photographs of adult birds by themselves during the nesting season, our difficulties are greatly lessened, for we have one point to which the bird is unfailingly attracted, the nest or the place where the young are hidden being the attraction, that is, the point to which we should devote ourselves. If we stand near the nest, or even place an object such as the camera near it, we will notice that the birds usually select some particular twig on which to perch each time they come near the nest or their young. Here is our opportunity; focus the camera on this point, and make the exposure when the bird assumes a suitable attitude. In case there is no conspicuous perch for the birds, place a dead branch where you wish them to come, and more than likely they will take advantage if it offers

them a clear view of the camera or other offending object.

Throughout this work the bird photographer must be quick to avail himself of favourable conditions and ready to overcome the endless difficulties which will at one time or another beset his path. The powers of resource combined with patience have more to do with the success of the work than the following of rules and formulas. The truest proverb to be borne in mind by the bird photographer is that "necessity is the mother of invention." Being always ready with expedients does much to insure success.

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CEDAR-BIRD IN WILD CHERRY TREE.

CHAPTER III

PHOTOGRAPHING ANIMALS

PART I

WILD ANIMALS AT LARGE

Outfit required.—Camera preferably the graflex or some such type of box that allows of focussing while the plate is ready to be exposed and has a draw of bellows sufficient for the use of low-power telephoto lens. Long-focus lens of great rapidity, tripod, etc.

Few of the vast army of photographers realise what it is to hunt wild animals with their cameras; still fewer of the sportsmen appreciate the amount of sport which may be had when the camera takes the place of the rifle. They don't consider that for the camera there is no close season. Game of all kind —and all animals are the camera's game—may be hunted with more or less success at all seasons of the year. If we consider the skill required for camera hunting, we must realise that more is needed than when the gun is used; for it is necessary not only to approach nearer to the animal, but, even when near,

hours may be spent in trying to secure either a favourable place or a suitable attitude, and during all this time every precaution known to the hunter is called into practice. Stalk a deer with the camera and you will realise how small a thing will mar the chances of success. A twig incautiously broken, the grazing of the camera against a dry branch, or any of the hundred and one accidents that may at times happen to the still-hunter, and where is your photograph? Gone! Whereas had you been using the rifle you might easily have bagged your game. Stalk a big bull moose, even though it be during the close season, and unless you by chance find an animal that is absurdly tame, as occasionally they are, you will find excitement enough if you would come within fifty feet of the big creature. Learn all you can about still-hunting, do not relax your vigilance, and take nothing on chance, and you may succeed; fail in any one precaution, and you will have no picture.

Once when I was on a trip trying to secure some moose pictures, I came across a fine large bull; the situation was perfect from a pictorial point of view. He was in a large pond where the lily-pads were abundant; in the near background was a bank of trees, mostly birch; beyond stood Mount Katahdin in the misty distance; the moose was feeding in shallow water, the light was bright, and as the wind was in the right direction, everything pointed to a successful

TERN.

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picture. We were in a canoe; slowly and noiselessly we came through the smooth water; scarcely a ripple did the canoe make. Nearer and nearer, and still the bull had not seen us. When within about seventy feet (I was using a telephoto lens) I stood up slowly and quietly, while the animal was busy feeding. No sooner was I in position than he looked up. A finer picture could not be imagined. His enormous antlers, still in the velvet, seemed almost out of proportion to his size. And he stood absolutely still while I, trembling with excitement, focussed the camera and pressed the button. Instantly the huge beast made a dash for the shore and in a second was lost to view, and I sat down congratulating myself on having secured such a splendid picture. Imagine my disgust when, on going to change the plate-holder, I discovered that in my excitement I had neglected *to draw the slide*. My chance was gone, and never again did another such opportunity present itself. All of which only goes to show that coolness and presence of mind are as much needed in stalking animals with the camera as with the gun. Every little detail must be thought of. That sounds easy enough, but how often it happens that we lose our very best chances through forgetting some trivial item! The only way to avoid such experiences is to have a regular system of examining the camera when about to make a picture; have a regular routine, and

follow it out in all cases. It becomes a habit, so that after a time we do it automatically.

The question of a camera for this branch of work is perhaps more important than in any other. A tripod camera is in nearly all cases out of the question, except for small animals. An ordinary hand-camera has the objection that one has to guess at the focus, a most difficult thing to do; and most hand-cameras are made to use a short-focus lens, which in wild-animal work is utterly useless. From my own experience the graflex camera seems the one best fitted to the work; its great length of bellows will allow the use of the hand-camera telephoto lens, which has a magnification of 3½ diameters. Armed with such an instrument, almost any kind of work may be done, and with the least possible difficulty and the greatest possible chance of success. It is perhaps needless to say that no outfit is complete without a telephoto lens. For animal work the kind known as the hand-camera one (such as that made by Bausch & Lomb) is the best; it only magnifies 3½ diameters, but that is as much as can safely be risked for hand-camera work or when the objects are constantly moving. With a plastigmat fitted with one of these telephoto lens I have made exposures of one hundredth of a second on live animals in motion, and obtained very fair results. This was on a bright day, of course; in cloudy weather one

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DOWNY WOODPECKER.

Calling while climbing apple branch in search of food.

Copyright, 1900, by A. R. Dugmore.

PHOEBE

Photographed by means of a mirror, the sunlight being thrown on the bird, who perched frequently on this dead twig, which was in shade.

fifth will yield a perfectly exposed plate. For all animals that can be approached near enough, use a long-focus lens in preference to the telephoto, as the lens without the telephoto attachment is both quicker and more easily focussed. The plates necessary for the work must be of extreme rapidity. Isochromatic plates will of course give somewhat better results so far as the general landscape is concerned, but, owing to their sensitiveness to dampness, they are scarcely to be recommended except for trips of a week or so. The exigencies of camping do not allow of the care necessary for their protection.

As has been said before, a short-focus lens is of practically no use in animal photography; when large animals are the subjects, they are rendered too small unless you are fortunate enough to be able to approach to within very short range. Even then the results are far from satisfactory. The shorter the focal length of the lens, the greater will be the distortion due to the exaggerated foreshortening, so that for all animals, large or small, use a long-focus lens — the longer the better, so that its speed is great enough. For a four-by-five plate I use nothing less than a nine-and-a-half-inch lens, usually one of still greater length. Do not forget that the light in the woods is much less powerful than it appears to be, so that it is seldom safe to make instantaneous exposures even with a rapid lens, while the telephoto

attachment can only be used with a time exposure. Absolutely safe plate-holders are more important in wild-animal work than in any other, as, owing to the varying conditions, the roughness of the country in which the work is usually done, the length of time that a plate has to be ready for use with the slide drawn, and the difficulties of guarding against possible danger of having the plate struck by light by protecting the camera with a black cloth, the plate-holder is subjected to the most severe tests.

It is impossible to give precise instruction for photographing animals; each species is so different in its characteristics that what would be true of one kind might be absolutely untrue of another. Not only does each species require particular treatment, but frequently individuals of the same species are so entirely peculiar in their habits as to require entirely different methods. Sometimes we find squirrels that will pick up a nut when thrown to them, and sit down to eat it while we secure the picture, while others will scamper off and on no account allow themselves to be photographed. Still more noticeable is the individuality of any of the deer family. I have seen a two-year-old bull moose, after making a wild dash away from the canoe, come back and begin feeding within forty feet of us, remaining thus for ten minutes or more while I made a number of exposures. We were in plain view all the time, and the wind

PORCUPINE IN ITS WILD STATE.

A WELL-BEHAVED 'POSSUM.

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blew directly from us to him; yet, for some unknown reason, he entertained no fear of us, even though we talked and moved about without taking the slightest precaution.

Of all the animals none is easier to photograph than the 'possum. Whether he is very foolish or exceedingly smart, I have never quite made up my mind. His slowness of movement enables us to control his whereabouts so that with little trouble he can be photographed in almost any place or position. Occasionally he acts "cussed mean" and will do nothing but "play 'possum." Take him by the tail (the only natural way to hold him) and place him on a branch; he will not so much as hold on, but will let himself fall, even though the distance be great. Nothing you can do will make him show signs of animation until it suits his convenience. But once he is in his right mind he is a perfect model for the animal photographer. Another excellent subject for the camera is the porcupine. The only great objection to him is that he cannot be handled. His movements may be influenced by pushing him with a stick, but that is done only at the loss of some of his quills. One time I had some photographic illustrations to make for a magazine. The story dealt with a porcupine. In making the pictures I "used up" seventeen animals; that is to say, in trying to induce them to assume the attitudes I

needed, they lost so many quills that their beauty (what little they possessed) was completely destroyed, often without an exposure having been made.

Small animals such as mice are most satisfactory in pictures, and they may be photographed with comparatively little trouble. The best pictures are those which show the old and young together. Sometimes the nest is a satisfactory accessory. But in all cases choose such surroundings as would illustrate something of the animals' life and habits. You will probably find difficulty in restricting the range of most small wild animals; if so, try using a glass box, or a box with a glass front. In this arrange your accessories, and make the exposure when the animal assumes the position you wish. To avoid reflections on the glass let the sun shine directly on it and don't use a very dark background.

PART II

WILD ANIMALS IN CAPTIVITY

Of all branches of photography there is none so deceptive as the photographing of animals in the Zoos. Nothing appears so easy, and yet the difficulties are far greater than one would ever believe. Of course, if you do not object to the bars showing between the animal and yourself, why, then it is easy enough.

PRAIRIE DOG ON EDGE OF ITS BURROW.
In the Washington National Zoo.

A PAIR OF PRONGHORN ANTELOPES.
Photographed in the Washington National Zoo.

But when you want really good pictures, pictures that show the animal in striking and characteristic attitudes, away from the objectionable bars, then I say the work is difficult. At first thought one would say, "That 's easy enough; I could make twenty or thirty photographs a day without the slightest trouble"; but the first day spent in the Zoo would disillusion you, and you would be more humble, and think yourself in luck if you made six or eight good pictures. With a tripod-camera the work is absolutely disheartening, one good picture being frequently the result of a day's hard work; but with a hand-camera with which you can focus accurately, better work can be done, and with infinitely less trouble.

The animals may be divided into two aggravating classes: those that are too tame, and those that are too wild. If anything, the latter are the easier to manage. You can get pictures of these even if they are rather far away. But the animal which insists on putting his nose through the bars and licking the lens tries one's patience to the limit. There is a large gray wolf in the Bronx Zoo (New York) that I have tried a number of times to photograph, but so far without success. In fact, I never made but one exposure, as I could not get far enough away. He always wants to lick my hand or the camera. With some of the animals it is curiosity which

prompts them to come so near; but with many it is the spirit of friendship, and with these, though they are most exasperating, one cannot be angry. While the animals are being fed is usually the best time to secure photographs, as then their attention is devoted to the food, and to watching each other, if there are several in a cage, and the camera has little or no attraction for them. If the rules of the Zoo permit visitors to feed the animals, it is a good plan to come provided with such dainties as would be most appreciated. By placing the food where you wish your subject to stand, you may be sure of his going there; only you may generally be equally sure of his back being turned toward you. So the best way is to throw food to a point farther from you than you wish the animal to stand, then when he is there throw another piece nearer; in this way, as he has to turn back to get the food, he will be more likely to stand either facing or broadside to you. By such methods you can sometimes induce an animal to overcome its natural aversion to going to the place you wish. Whenever possible it is advisable to avoid having the iron bars and other such unnecessary and unbeautiful objects show in the picture. A way to overcome this, where it is impossible to secure a picture without the bars, is by double printing; that is to say, block out all the background on your negative, leaving the animal only; then make a

picture of a suitable background, being careful to keep the correct proportion of things, and print your animal into this scene. By this method[1] beautiful results may be obtained with comparatively little trouble.

Remember that what was said in Part I of this chapter regarding the advantages of using a long-focus lens applies to this branch of photography almost more than to any other. The grotesquely foreshortened animals we see in pictures made with very short-focus lenses are an object-lesson to those who think there is too much fuss made about lenses and see no advantage to be gained by using a lens of long focus. As regards the lighting of the animal there is not much to be said that would be of any value. White animals look best when the light is on the farther side; that is to say, the animal should stand between the camera and the source of light. This applies more particularly when strong sunlight is used. Dark-haired animals usually require to be strongly lighted. The distribution of the light and shade means so much in the picture that careful thought should be given to the subject. Strong sunlight is frequently a thing to be avoided, notwithstanding the beginner's usual idea on the subject. A really bright cloudy day is, for all-round work, the most desirable. Pictures taken under such conditions are softer and more full of detail.

[1] Double printing is more fully explained in Chapter I, Part II.

PART III

PHOTOGRAPHING DOMESTIC ANIMALS

HERE we have a most delightful and thoroughly satisfactory branch of work; the difficulties are not great and the possibilities almost unlimited. Here it is that the photographer shows whether or not he is an artist. Having more or less complete control of the animal, he can arrange his subject so that the lighting will be effective, and the surroundings are, of course, at his disposal. All domestic animals are fit subjects for pictures, from the fat sow and her litter of pink sucklings, to the soft, velvet-coated Angora cat. Whether the animal is the entire subject of the picture or only incidental, he is an equally fit object and deserves the same consideration. Beautiful pictures may be made of animals' heads, but, curiously enough, this is not done as commonly as might be expected. A fine horse's head is in itself a splendid subject for a picture; the same may be said of a dog's or of almost any animal's head.

All that has been said about lenses applies here, but in the way of a camera it is perhaps best to have both a focussing hand-camera and one of large size to be used on the tripod when short-time exposures are possible. There is every advantage to be gained by using isochromatic plates of both me-

TREE-TOAD.

TREE-TOAD.

An excellent example of protection marking.

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dium and great rapidity according to the subject, though for animals whose colour is gray or any neutral colour ordinary plates will answer. For dogs, horses, or other animals in rapid motion the focussing hand-camera fitted with the focal plane-shutter is indispensable. Such pictures are, however, seldom beautiful, even though they may be interesting. The rapid action of an animal looks grotesque when caught with the camera; its attitudes never appear to be natural or correct, and as a matter of fact the positions are not correct as our eyes see them. We see rather the effect of movement than the actual positions assumed by the different parts of the body. All the most beautiful animal photographs are of animals in repose. Such pictures have been given sufficient exposure, and should be soft and delicate, lacking the strong, hard black-and-white effect of the instantaneous photograph.

CHAPTER IV

PHOTOGRAPHING REPTILES

Outfit required is the same as for animal work.

The idea of photographing reptiles does not, as a rule, appeal very strongly to us. We think of little that is beautiful in connection with this order of animal life. And yet, if we stop for a moment to consider, we will find that not only do the reptiles offer us material that is extremely interesting, but many forms are really beautiful. Some of the lizards, for example, or the snakes, are graceful and at the same time beautifully marked. Even the frogs are no mean subjects for the camera; very effective pictures can be made with them if the surroundings are carefully arranged. When photographing a frog there are many ways of treating the subject: in the water, such as a shallow pond, on land, or, what is most satisfactory, in an aquarium. The latter offers the greatest possibilities; as the creature is unable to get away, you can arrange the accessories to suit. Moss-covered stones, grasses, and aquatic plants all help to

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BULL FROG RESTING AT SURFACE OF WATER.

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BULL FROG STANDING HALF SUBMERGED IN WATER.

make the picture beautiful and interesting. Curiously enough, a photograph of water taken at close range does not give the effect of water. A piece of glass inclined downward toward the camera does much better. It may be placed on gravel or anything equally suitable, and a piece of sod placed so as to conceal the edge will give a perfect effect of water, reflections and all.

In photographing tadpoles during their different stages of development, they should be put in an aquarium. A piece of glass laid horizontally against the front glass will keep them from the bottom and near the front. With full sunlight the reflections from the glass will not cause trouble, provided the background is not dark. When photographs of snakes are wanted, the first thing to do is to learn to handle them without fear. With the harmless varieties there is no reason why we should be afraid of them; but our instinctive dread of anything snake-like is difficult to overcome. Once we let our common sense assert itself, it will be found by no means difficult to photograph any of the smaller snakes. A snake taking a sun-bath will usually allow us to approach to within a few feet if we move quietly so that it will not be frightened. Of the reptiles there are few more exasperating than the common box-tortoise. He will shut himself up in his house and positively refuse to be seen or photographed. I have spent

hours in unsuccessful attempts to secure pictures of these exclusive creatures. Either they will keep their shell tightly shut, or else they will be too active and keep on the go with such vigour that a good picture is almost impossible.

In order to illustrate some of nature's wonderful methods of protection by means of colouring, marking, and form, we can find few better or more striking examples than some of even the common varieties of insects. There are some which closely imitate flowers, leaves, twigs, bark, or grass, while others, such as some of the grasshoppers which live in dusty or sandy places, are without conspicuous markings, and of a colour that corresponds almost exactly with their surroundings. In a drawing, however well executed, we always have a feeling of doubt as to its accuracy, and this doubt increases in proportion to the closeness of resemblance between the insect and its surroundings. It is therefore to the camera that we must look for a truthful and convincing picture of these extraordinary examples of nature's handiwork.

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GARTER SNAKE.

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SNAPPING TURTLES FIGHTING.

CHAPTER V

PHOTOGRAPHING INSECTS

Outfit required.— Long-focus camera (focussing hand-camera by preference). Rapid long-focus lens with telephoto attachment. Rapid ordinary plates (occasionally isochromatic plates are necessary). Tripod and other ordinary appliances. Microscope with photo-plate attachment.

THIS is a most fascinating field for camera work, and a field that is not very often entered. The many and various difficulties to be overcome, the enormous range and diversity of subject, the intensely interesting material which may be procured with so little difficulty, all help to make this branch of photography of the greatest possible interest. Not only are there the insects visible to the naked eye, but also the vast throng of microscopic life, so remarkable in its infinite variety of form.

Beyond the few pictures of butterflies and moths and dragon-flies, we do not see many insect pictures. Occasionally a spider is photographed. But yet we may say that insect photography is in its infancy. The camera of the graflex type is undoubtedly the one best suited to this kind of work, even though

frequently a tripod will be found necessary. Any camera, to be of all-round use, must be arranged so that it may be pointed directly downward or upward. A picture of a strider that I once used was made with the camera pointing almost straight down. I had been asked to make a picture that would show the insect and his peculiar shadow. After trying many times and without success to secure such a picture while the insects were in a small stream, I finally had to catch some of the lively little creatures, and put them in a white-lined box with about an inch of water. In this way it was easy enough to make the photographs of both insect and shadow.

Photographs of some varieties of wasps make interesting pictures, as with little difficulty they may be portrayed while at work building their mud house or delicate hanging comb. These are but suggestions of the endless subjects possible in insect photography. To go into the subject at all thoroughly would entail writing a book on entomology, and the writer has neither the ability nor the desire to attempt such a work.

MOTH UNFOLDING ITS WINGS AFTER LEAVING COCOON.

CHAPTER VI

PHOTOGRAPHING FISH AND OTHER AQUATIC LIFE

PART I

THE AQUARIUM AND OUTFIT

Outfit required.—Long-focus camera. Rapid lens. Plate-holders. Focussing-cloth. Instantaneous isochromatic plates. Aquarium—two wooden horses; two boards about seven feet long; bucket; rubber tube; sponge; cloth (for polishing glass); scrub-brush; claw-shaped tongs; small landing-net.

UNTIL quite recently fish photography was almost untrodden ground. Few had attempted it, and fewer still had succeeded. The new interest in natural-history subjects, with its absolute demand for "photographs from life," has led, after touching on almost every other branch of work, to the photographing of fish, and almost every month we hear of some person taking it up. Though not so interesting as bird and animal work, it has, nevertheless, many points of interest, and, like all other nature photography, it teaches us a great deal that hitherto has never even been thought of.

The first thing to do before undertaking fish photography is to prepare a special and somewhat elaborate outfit. Besides the camera, lens, etc., there must be a suitable aquarium, and this will have to be made to order. When having it constructed, consider first of all what will be the length of the largest fish you intend to photograph, and have your aquarium at least four inches longer. It is not advisable to attempt fish longer than twenty-eight inches (except such as the garpike or other slender fish), as they are very difficult to handle. The aquarium may be of the portable type, though this has no particular advantage and is seldom water-tight. It is better, therefore, to build one strongly, so that it will not break apart or leak. Then it can be packed ready for shipping by screwing a heavy board over the glass and top.

Good quality of clear white pine is about the most satisfactory wood to use. It should not be less than seven eighths of an inch thick except for a very small aquarium, when half an inch would do. The best way to insure its being water-tight, notwithstanding what the carpenters will tell you to the contrary, is to cut a shallow groove, B (Fig. 1), along the parts that come in contact. In this groove lay rubber tubing, which may or may not be sealed at either end. When the parts are drawn together by means of long screws (brass by preference) the

rubber will come in contact so tightly that leakage will be impossible. The wood should be *thoroughly* shellacked before being put together.

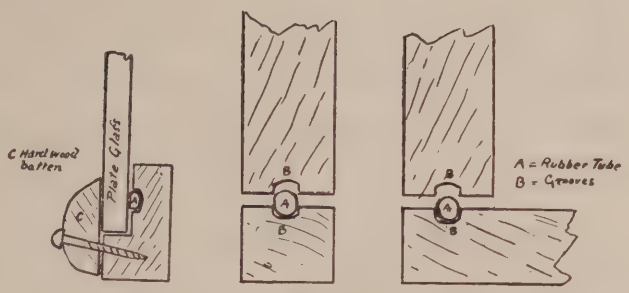

Fig. 1.

The glass must be of the best white plate, free from bubbles and imperfections. The thickness of it depends on the size of the aquarium; one twenty-six inches in length would require the glass to be quite a quarter of an inch thick. If no plate-glass is obtainable, a mirror can be cleaned, and, if a good one, will be found to answer perfectly.

The method of fastening in the glass is shown in this diagram. The rubber tube A (Fig. 1) is laid in the groove and the glass pressed tightly against it by a batten of strong wood such as oak; this, when screwed in place, will hold the glass. The batten should be bevelled, as shown in the diagram C (Fig. 1), in order to prevent its being reflected in the glass. On the upper side of the glass no batten is needed unless the tank is very large. The batten has the disadvantage of casting a shadow, which shadow usually falls on the fish. Heavy copper wire tightly twisted and attached to two strong screw-eyes will

hold the sides together. The wire may be removed and a batten substituted when the aquarium is to be packed. When the tank is made it should be smoothly lined with white oilcloth. This is easily cleaned, and its bright surface reflects the light and therefore prevents heavy black shadows.

It will be noticed that when a fish is placed in the aquarium, after stirring up any accessories that may have been arranged, he immediately retires to the farthermost corner, out of reach of the camera. To prevent this his range must be restricted, and the best way to do this is by placing a sheet of glass in the grooves as shown in Fig. 2. The smaller the fish the nearer to the front must this glass *fence* be put. With large fish it is not safe to restrict their movements too much. It makes them very restless and frequently results in their breaking the glass or killing themselves. The glass partition serves also to prevent the fish disturbing the aquatic vegetation which adds so much to the beauty of the picture. This subject will be more fully dealt with later on. It is not advisable to allow the partition to rest on the bottom,

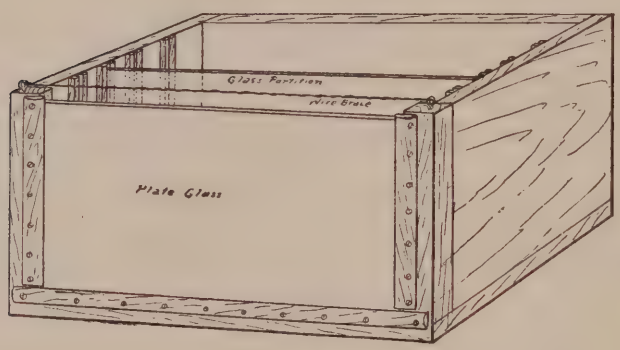

Fig. 2.

as by so doing it interferes with the circulation of the water. A small block placed inside the grooves at the lower end will prevent this.

An extra bottom board covered with white oil-cloth will be found useful when photographing fish that stay on the bottom. This board should have an arrangement by which it can be tilted so that the end farthest from the glass may be elevated.

Handles at either end of the aquarium are useful, but they should not be used when it is full of water; the strain is too great, and is likely to cause leakage. So much for the aquarium. Now we come to its support, and for this I can recommend nothing more simple or more efficient than a pair of wooden horses, upon which two long thick boards should be placed. The length of these boards must depend on the focal length of the lens that is used. The camera placed on these boards, as shown in the accompanying diagram (Fig. 3), may be moved back and forth at will. It is seldom necessary to raise it more than a couple of inches, and this may be done by using one or more thicknesses of board beneath the camera.

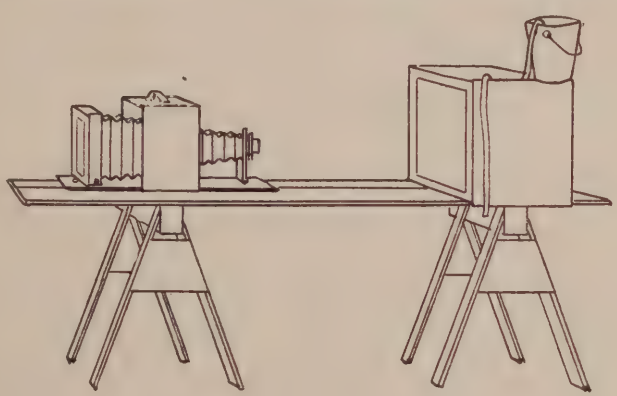

Fig. 3.

I have never found that the camera needed to be secured, its own weight being sufficient to hold it in place. If desired, an arrangement could be easily devised by which it would be secured to its support.

With regard to the lens used in fish photography, the more rapid it is the better will be the results. There is no particular advantage in its having very great focal length. About nine and a half inches for a six and a half by eight and a half lens is sufficient. The type of shutter that will be found most satisfactory is the focal plane; not the drop-shutter in front of lens, but the kind that is set close to the plate. This gives the maximum illumination with the shortest possible exposure, such as is made necessary by the rapid movement of fish. With fish, such as the salmon family, the bluefish, and the runners, jacks and pompano, only the most rapid shutter can be used with success. Another advantage in having the shutter concealed is that fish frequently splash the water, and lens-shutters, such as the diaphragm pattern, are rendered useless by salt water.

In the list of material required for this work will be found instantaneous isochromatic plates. Under ordinary conditions these plates are perhaps not quite so rapid as the regular plates, but with the greenish or yellowish tinge of the glass and water, and the greens, yellows, and reds of the aquatic vegetation, it will be noticed that most of the colours are those

which most easily affect the isochromatic film. Therefore in fish photography they will be found not only as quick as the ordinary extra-rapid plate, but, owing to their sensitiveness to the colours just mentioned, will yield a more perfectly exposed negative. Their value will be most noticeable when the fish to be photographed is strongly coloured, where bright yellow, red, and dark green may be side by side. The ordinary plate would show only a slight difference of tone between the yellow and red, and perhaps none at all between the red and green, while the instantaneous isochromatic would show a decided difference in the three colours. Not giving the red its full value, of course, because that can only be obtained by using the slow isochromatic or by the addition of a ray-filter. It is a rare thing, however, to find a fish that will remain quiet enough to allow of these being used.

PART II

ACCESSORIES AND THEIR PREPARATION

To any one who has not attempted fish photography it would seem an absolutely easy matter to beautify the aquarium by adding vegetation and stones as a background for the fish. That is exactly what I thought when I first began aquatic photography, but it did not take me very long to discover how mis-

taken were my ideas on the subject. Absolute clearness of water is highly desirable, but almost impossible to obtain. After straining the water so that it is clear enough for ordinary work in a good light, take an apparently clean stone, not a smooth marble of course, but an ordinary, moderately rough stone, drop it into the aquarium, and watch the result. The water will be seen to be filled with a muddy substance, and instead of crystal-like clearness we have a murky-looking water that is most undesirable. But your troubles have only just commenced. · Add some fresh green aquatic plants, and you will notice that they too give off scum and muddy material, even though they may have been placed in the water with the greatest of care. Now when the fish runs amuck through these beautiful plants, and really disturbs the mud and scum, the water has lost all its clearness, so that it is absolutely impossible to photograph a fish through it. With tropical aquatic vegetation the difficulty is even greater than with our more simple northern plants.

The beautiful "sea-feathers" that one sees waving about with every movement of the water in the tropical seas appear to be a clear, clean yellow or purple; but on putting them into the aquarium they will be found to discolour the water immediately. "Sea-caps" are even worse, and sponges cause so much trouble that after a few discouraging attempts

PART III

HANDLING AND PHOTOGRAPHING THE FISH

Fish, having nothing in common with us, as have the birds and animals, are difficult to handle because we do not understand them and their ways, for we have no standard by which to judge them. They do not as a rule appear to be easily frightened, nor indeed do they pay much attention to things about them. Strong light and the restriction of their range affect them more than anything else. Some varieties do not even object to being handled, while others will not allow themselves to be touched. Evidently fish have individuality, and this individuality applies not only to species, but to different fish of the same kind. As a rule we find the chub, carp, and tench are dull and slow and therefore easily photographed, while trout, salmon, and black-bass are nervous and difficult to handle. But occasionally a quiet, well-disposed trout or bass is found; while, on the other hand, we sometimes find an individual trout or carp or tench so nervous and wild that it cannot be used. I mention this because I may allude to certain fish as being difficult to handle, when the reader attempting to photograph the same species may experience not the slightest difficulty.

If the fish to be photographed is a common one,

do not waste time and patience with a wild individual; rather let it go, and try your luck with another and perhaps tamer one. In the end you will not only save time by so doing, but you will secure a better and more satisfactory photograph. Of course it is understood that the aquarium must be placed in a strong light. The better the light the better will be the picture. On the end of a wharf is the best possible place, for there, while having the benefit of uninterrupted sunshine, you have water convenient, and — what is not to be despised — the advantage of any cool breezes that may happen to blow. It also allows you to keep the fish that you are not actually using in a live-car (a perforated box placed in the water), which should be kept in the shade. It is a good plan to have a small canopy of some sort that will shade the camera and plate-holders. This will save many plates from fogging.

Now that everything is in readiness, the aquarium filled with clear water, and a suitable background arranged, we will commence fish photography. Supposing the fish is in the live-car, a small landing-net will remove it to the aquarium. Be careful in doing so not to injure the scales against the edge of the glass. In some cases it is better to take the fish in both hands, holding it firmly but not too tight, and place it carefully in the water between the two glasses. At first probably the fish will swim rapidly from end

YELLOW ANGEL-FISH
Showing its natural

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to end in its efforts to escape, but after a few minutes of useless excitement it will usually calm down and lie on the bottom. Now is your time to focus and arrange your camera. We will say the fish is twelve inches long and the aquarium thirty inches long. It is obvious that if a fairly large image of the fish is wanted, only a part of the aquarium, perhaps eighteen inches, will be covered by the plate. To avoid a lot of unnecessary trouble and an extra chance of failure, place two marks (small pieces of *wet* paper will answer, don't use paste or mucilage) on the glass at the extreme edges of the part covered by the plate. This much done, set your shutter according to the exposure to be given, and then coax the fish away from the bottom. This may be done either by means of a stick or with the hand. It usually requires a great deal of patience and not a little time before the fish can be induced to go just where one wishes, but as so much depends on its being well posed, it is better not to be in too great a hurry. When focussing on the fish be sure to look *down* on it through the water, otherwise you cannot tell how far it is from the front glass. In the same way, before you release the shutter be sure the fish is at the same distance from the glass as it was when you focussed the camera. In case you cannot induce the fish to remain clear of the bottom, there are two things to be done: one is to raise it with your hand

(holding the bulb of the shutter in the other hand) and make the exposure immediately after releasing the fish, when the hand must, of course, be instantly withdrawn. In this way I have often succeeded in making photographs that I could not otherwise have made. This method, needless to say, requires a very short exposure, as the fish is in motion, whether it sinks rapidly to the bottom or swims.

The other way is to place a stone on the bottom so that a point of it will be up several inches. Then gradually and slowly move the fish with a stick until it rests on the edge of this stone. When exactly in the right position (the head should be slightly below the level of the tail) make the exposure, which need not be so very short, as the movement of the fish would not, in all probability, be nearly so rapid as when actually swimming or sinking. Only a small part of the stone should come in contact with the fish. An important thing to remember is that the dorsal fin be elevated; not only is this desirable for the identification of the fish, but it adds greatly to its beauty. With the dorsal fin down the fish lacks the appearance of being alive.

While it is quite possible to keep track of undeveloped plates so that you know what each one is when developed, I would advise as the safest and easiest method that a white label, bearing the name of the fish in heavy black letters, be placed on the

MOONFISH.

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glass so that it comes on the extreme edge of the plate. Then, when the photograph of the fish is made you have the name on the negative. This prevents any possibility of error. The paper label, if wet, will adhere to the glass, and may be removed without any difficulty.

In photographing fish that are habitually found in swiftly running water, some device might with advantage be used in order to keep the vegetation bending over, all in one direction of course, thus giving the effect of a current. This may be accomplished by attaching a very fine thread to each plant, that they may be drawn over to the proper angle. This is rather a "fake" way of doing it, and not altogether satisfactory. A more elaborate method would be to have several large openings at one end of the aquarium through which the water would run freely, while on the other side an equal quantity of water would have to be admitted. Though I have never tried this, I believe it would give a good effect of swiftly running water, which would not only keep the plants in the desired position, but would force the fish to assume a natural and lively attitude, as though it were in a brook. The rapid movement of the fins would, of course, necessitate a very short exposure.

With surface fish it is a good plan to have the water several inches above the partition glass; then, at

the moment when about to make the exposure, disturb the water's surface with your unemployed hand. It is surprising what a good effect is produced by this trick.

A peculiarity that is most noticeable among the highly coloured tropical fish is the power that they have of changing their colour and their markings. Take, for example, some of the porgies, that large family of fish so abundant around Key West. The same fish might be photographed ten times in as many minutes, and no two photographs look like the same species. The fish is beautifully marked with vertical bars, pink, blue, yellow, green, and brown being the prevailing colours; and yet one photograph will show a plain silver-coloured fish, absolutely lacking in marks of any kind, another will show faint irregular blotches, another slight indications of bars, and yet another will show the fish in all the glory of its full markings. The yellow-fin grouper, still more pronounced in the pattern of its markings, though scarcely so brilliant in colour, will change in an instant from a pale, sickly yellow with the markings only just discernible to a rich green with markings of very dark brown and bright red. Whether these changes are voluntary or not is scarcely known, and anyhow this is not the place to discuss that interesting question; but the surroundings will usually be found to have some effect on the colour

GARFISH.

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of a fish, even in an aquarium. Yet the effect produced by surroundings of a certain colour is by no means invariable. As a rule, however, when a brightly coloured fish is placed in an aquarium which is lined with white, and has no other colour, the fish will not don his finest colours; he remains, instead, pale and almost transparent, so as to blend in more or less with the immediate surroundings. A few stones added will sometimes cause a fish to resume part of his colouring; but when a quantity of rich vegetation is introduced, he will usually show himself off in his very best markings, perhaps only for a few seconds at a time, but more often for several minutes together.

This colour-changing is one of the most exasperating difficulties to overcome. We have so little control over it, and, according to the perverseness of things, it almost always happens that when a fish assumes exactly the attitude one wishes, it loses its colouring at the same moment. It is quite needless to say that an unlimited supply of patience is almost as necessary as the camera itself if we wish to have any success. I remember, when I began photographing the fish of Key West, having a red nigger-fish brought to me. It was of a beautiful delicate coral red, with tiny specks all over its head and body. I immediately placed it in the aquarium, and, after the usual amount of trouble, succeeded in making two expo-

sures which showed the fish in good positions. These, when developed, proved to be first-rate negatives, and I was quite satisfied until, about a week later, I procured another of the same species. Shortly after it had been placed in the aquarium, and I had commenced making a water-colour drawing of it, I was much surprised to see it suddenly change colour; dark purplish-brown markings in the form of irregular broad bars had come, changing and at the same time adding much to the beauty of the fish. I only tell this to show how much depends on knowing what to *expect* from a fish in the way of colour. Do not photograph a fish until you know what it should look like when it is at its best; otherwise the photograph, though true to life, will be misleading.

This colour-changing is not, so far as I know, noticeable with fresh-water fishes. At least, none that I have photographed has shown it except to a very limited degree. Nor is it to be found among the light-coloured surface fish, such as the mullet, mackerel, pompano, and jacks. These, having colours that are more or less transparent and iridescent, of blue, green, and silver, colours which render the fish inconspicuous, do not need the variety of colours and markings by which the bottom fish are protected. These bottom fish, whose home is among the brilliantly coloured vegetation, require colours as bright as their surroundings, that they may not be easily discovered by

their innumerable enemies. It seems very difficult for us to realise that the wonderful colouring of the various kinds of angel-fish should be a means of protection, but that such is the case is scarcely to be doubted.

When photographing any fish that "jumps" it will be found necessary to place either a piece of glass or wet cheese-cloth (wet because it is more transparent) on the top of the aquarium; otherwise they will leap out, even though the sides are several inches above the surface of the water.

In arranging the backgrounds for fish, their beauty may be greatly enhanced and additional interest be given by using such examples of sea life as would be found with the fish if it were in its natural home. Sea-anemones, crabs, urchins, and any of the various shell-fish add life and value to the picture. But do not use any kind that give off coloured liquids, such as the squids, sea-pigeons, etc.

In handling fish of any kind, more particularly the catfish and some of the salt-water species, it is advisable to guard against being cut by the sharp spines of the fins. The Key West fishermen tell of all manner of diseases that come from such cuts. Such stories are gross exaggerations, but it is nevertheless true that the wound caused by a fish's fin is frequently poisoned and proves very troublesome. Any one unused to handling fish will find it difficult to

avoid being cut. Therefore I advise watching how the fishermen do it. By so doing and by following their method much unnecessary inconvenience and pain may be avoided.

Should you ever be tempted to photograph the Portuguese man-of-war (*Physalia arethusa*), be most careful how you handle them. Do not let the tentacles come in contact with your skin unless you wish to enjoy the sensation of being stung by an infinite number of nettles. In photographing these interesting and beautiful creatures, some difficulty will be experienced. They are so light in colour, resembling as they do a very brightly coloured soap-bubble, that a white background is not desirable, while a dark one has the disadvantage of causing the glass to reflect the camera and everything else about it. Another difficulty is with the creature itself, which insists on coming in contact with the glass (this is probably due to capillary attraction) and when removed leaves a jelly-like scum on the surface of the glass. This, needless to say, must be cleaned off before the photograph can be made. I would suggest that a very thin piece of white silk, or other almost transparent material, be fastened tightly across the length of the aquarium at a distance of two or three inches from the front glass; this would, I think, keep the creature away from the glass without causing it to alter its form. In photo-

graphing any of the jellyfish or other *floating* forms of animal life, the same thing could be done to prevent their coming in contact with the glass.

Any of the lower forms of aquatic animal life may be more or less easily photographed, and in every instance it is best that they should be portrayed with accessories that are natural to them. It is astonishing that such an interesting branch of photography should so long have remained untouched. The possibilities are almost unlimited. The exquisite forms of plant life and the long list of animal life offer subjects as novel as they are beautiful; and the ease with which these pictures may be made once the first few difficulties are overcome will astonish any one entering this almost untrodden field.

CHAPTER VII

PHOTOGRAPHING TREES, SHRUBS, FLOWERS, ETC.

PART I

TREES, FLOWERS, FERNS, LEAVES, AND GRASSES IN THEIR NATURAL SURROUNDINGS

Outfit required.—Long-focus camera with swing-back and back focus. Fairly long-focus lens which need not of necessity be very rapid. Shutter, focal plane by preference. Focussing-cloth. Plate-holder. Tripod, one of ordinary height and one that will allow of the camera being placed within twelve inches of the ground. Isochromatic plates, slow and instantaneous. Ray-filter. Cloth screen to shield plant from wind. Pair of pruners.

In the foregoing chapters on photographing fish, birds, and other animal life, it will have been noticed that one of the things most necessary for the complete outfit is a plentiful supply of patience. Now, strange as it may seem, photographing growing flowers also requires a fair share of patience — far more than one would imagine. On an ordinary calm day, when to the casual observer the trees and flowers are absolutely motionless, it will be noticed that there is

SKUNK CABBAGE.
Leaf unfolding. April 19, 1901.

SKUNK CABBAGE.
Leaves nearly open. April 19, 1901.

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almost always a faint breeze which is sufficient to cause all flowers, especially those with long stems and heavy flower-heads, to keep up a constant movement. Seldom, except in the early morning and late evening, does one find a day so quiet that the flowers stand motionless. Were it not for that fact the photographing of flowers would be a comparatively easy task, requiring only the ordinary technical photographic skill.

One of the principal objects in photographing a growing flower is to show its environment as well as its form; therefore the individual flower chosen should be one that is growing under normal conditions in surroundings common to its kind. For instance, the blue-flag, which grows commonly in fields and swampy places, may occasionally be found in perfectly dry woods, quite away from water or swamps; it would be obviously absurd to photograph the plant in such a place, unless to show its eccentricity. In the same way the pink lady's-slipper is almost always found in woods, but once in a great while a single individual is found growing in a comparatively open place, such as a field on the edge of the woods. So it is with all flowers: they occasionally stray away from their natural locations and live a short life in surroundings utterly foreign to them.

It is well to select a plant that shows the flower in full bloom and the buds in various stages of develop-

ment. The same may be said of leaves when certain plants are under consideration. In this way the picture is a complete portrait of the plant, showing everything except the roots and seed-pods; and as these latter are so very seldom to be found on the plant while it is in bloom, they have to be photographed separately. With low plants whose flowers are near the ground, such as trailing arbutus, it is almost always necessary to accentuate the fact by placing a chestnut bur or an acorn, or some such object which would naturally be found on the ground, somewhere near the flower. This makes the fact that the flower is near or on the ground patent to anybody who sees the picture; otherwise they might think the flower was growing on a wall or even on a bush. Another good plan is to show a flower of another species growing near the one you are photographing, making it, of course, incidental and therefore less conspicuous. Its object is to show the season when these two plants are in flower. This, though by no means necessary, is frequently of interest.

Still another interesting idea is to photograph the plant at different times from the same point of view, showing its gradual development, being careful to keep notes of the dates. Pictures of this description taken in series are both interesting and instructive as illustrating, in the case of the wild flowers, how rapidly they come and go. It seems no time between the bursting of the

VIOLETS (*Viole bicolor*).

blossom and the drying of the seed that will be sown for the next year's supply. How quickly this takes place is frequently realised with almost painful acuteness by the photographer. To-day the woods may be full of a certain plant in all the glory of its gorgeous blossoms; then to-morrow perhaps it rains, and the next day we go to the woods to photograph the flower, and find its day is gone; instead of the fine, sturdy flowers, there are nothing but withered remains, shrivelled up and lacking all beauty, while here and there a single small flower hangs on as though unwilling to die. Search as you may throughout the woods, not a full-blossomed spray will you find, for the flowering period is past. It is as though an order had been given for the lowering of the colours of that particular plant.

Procrastination is a thing to be carefully guarded against in flower photography. Take advantage of every opportunity if you would succeed in making a good collection of pictures of growing plants; and such pictures are extremely interesting and well worth the trouble of making. Not only do the single plants show to their full advantage, but clusters or colonies of them growing together are depicted by the camera as they can be by no other means. What more beautiful picture can be wanted than an early summer swamp filled with blue-flag, or a late summer tangle of iron-weed, joe-pye-weed, purple asters, and golden-

rod? We cannot show the exquisite colour, but by using slow isochromatic plates the values of the colours are well preserved, so that the feeling of colour is in the picture. In securing such photographs a good deal of technical skill is necessary, for the negative must have the rare quality after which we are all striving, that is, the peculiar combination of softness and vigour. Practice alone will give you this, and even the most expert photographer must count real successes as things that do not often happen unless he has complete control of the conditions under which his pictures are made, and of course, in working out of doors, with the ever-varying quality of light and diversity of subject, the conditions are so changeable that it requires great skill to produce much evenness in the quality of the photograph.

In picturing flowers it is usually necessary to use a fairly small diaphragm, as the camera is often quite near the plant, and, with few exceptions, the leaves will protrude toward the camera. Having to work with so small an aperture, with an object as unsteady as a flower, it is obvious that there is every advantage to be gained by employing a lens of great rapidity, though, of course, much good work is done with ordinary lenses.

Isochromatic plates are nearly always necessary, and at times a colour-screen may be used with advantage. It is in the use of this colour-screen

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PINK HEPATICA.

April 23, 1901.

or ray-filter that the beginner usually fails. He uses it when it is unnecessary and neglects to use it where it should be used. In photographing a blue flower with even fairly dark leaves, the ordinary plate, being highly sensitive to the blue and very slightly sensitive to the green, does not give the colour values correctly: the blue is too light and the green too dark. The colour-screen or ray-filter will correct this. The common fault is in using the deep-coloured screen when photographing a red or orange flower. The ordinary plate, being only slightly sensitive to the red, orange, and green, requires a longer exposure than when other colours predominate, but gives the values of these colours fairly accurately; the deep-coloured ray-filter only tends to increase the exposure necessary. For most flower-work the medium isochromatic plate is the most satisfactory. If the flower is very shaky the quickest plates are best, and if white flowers with dark green leaves are to be rendered accurately, then use the slow plate or the ray-filter; this will hold back the white and give the green better value.

When photographing very delicate flowers, it is a good plan to place around them a screen of white or light-coloured cloth that will protect them from the wind and at the same time reflect more light. This cloth should be stretched tightly on upright sticks, which should be firmly planted in the ground, not

too near the plant. For outside work a background may frequently be used with advantage. It should be without wrinkles and of a soft gray colour for most flowers; by placing it in strong sunlight or tilting it so that it will be in shadow, or by putting it at different distances from the flower, it will give many gradations of tone, from dark to very light. When photographing flowers on branches, be sure to secure the branch; otherwise the slight swaying caused by the least motion of the air will bring it nearer to or farther from the lens, with the result that it will not be in focus.

Pictures of trees are made more interesting if separate plates are made of the leaves, flowers, fruits (which should be all the same scale), and bark, as well as the entire tree. Nonhalation isochromatic plates are most satisfactory for tree pictures; they insure the necessary sharpness of outline, free from the disagreeable defect known as halation.

The lighting for all flower- or tree-work is very important. For trees the most satisfactory results are to be obtained when the sun is low and the shadows long. For flowers the lighting must be such as will best show the form of the flower. The entire shape of flowers may be wrongly depicted if the lighting is wrong. White flowers should never have strong light streaming directly *into* them; not only does it flatten them, but it makes them too white

BLOOD-ROOT AND HEPATICA APRIL 19, 1901.

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and chalky. When the leaves are very highly polished, so that they reflect white light, it is best either to choose a gray day, or else intercept the sunlight by means of a cloth of some kind. Most ferns are easy subjects for the camera; they are usually fairly steady, and their strong outlines and beautiful forms are most satisfactory as photographs. Some of the grasses also make beautiful pictures, whether shown singly or in masses. In fact, there are few things in the vegetable world that do not lend themselves more or less to camera work. The commonest things that we pass by every day, such as the lacelike wild carrot, the much-despised yarrow, the timothy or the redtop in flower, are fitter subjects for pictures than many of the less common and therefore more appreciated flowers.

PART II

PHOTOGRAPHING CUT FLOWERS, LEAVES AND FRUITS

Outfit same as Part I, with the exception of a short tripod and the addition of several different-coloured backgrounds.

With cut flowers the greatest difficulty is in keeping the flower from wilting. How delicate flowers are can only be realised by those who undertake to photograph them. This is especially true of the wild flowers. After they are picked, with some few exceptions, they are not fit to be used for many hours.

If used too soon they will move all the time; this movement is so slow as to be almost imperceptible to the eye, but it will be revealed by even a fairly long exposure. The best way to avoid this is to pick the flowers in the afternoon, and put them in water or in a damp box and leave them in a cellar or other such cool and dimly lighted place overnight. In the morning they will be found strong and in full bloom, when they should be photographed without unnecessary delay in a cool place free from draughts. For some flowers the damp box is much better than water. Any ordinary wooden or tin box will answer if it is lined with thoroughly damp material such as paper, felt, or cloth, and covered over with a wet towel. If a flower is very full blown this is the best way to preserve it overnight. Flowers to be photographed may either be cut or pulled up with complete roots. For pictorial effect the former is the better, but of course if the roots are shown the portrait of the flower is more perfect and certainly more interesting, but it is also more difficult to arrange. One way to overcome the difficulty is to lay it on a piece of clean glass and photograph directly down on it. The background is of course placed at some distance from the glass; care must be taken to avoid the reflection on the glass. Another way is to pin the plant to a vertical background with very small pins, which must be arranged so that they will

FRINGED GENTIAN.

not be seen. Either of these methods may be applied to cut flowers and leaves, but the former method is much the more satisfactory.

A useful arrangement for cut flowers is a soft-wood board several inches wide attached so that it may be set at any angle; flowers, or branches of flowers, leaves, or fruit, may be fastened to this by means of fine nails or steel pins. A piece of wet absorbent cotton wrapped around the stem will keep the flower fresh for a sufficient length of time. An ordinary well-lighted room will answer for a studio, but of course a top light is an advantage. An abundance of light is almost essential so that the exposure may be as short as possible. How sensitive flowers are to the slightest vibration will be discovered before many pictures have been made; with some flowers a door banging in any part of the house will cause them to tremble violently, and even a person walking across the floor in another room will affect them. So it is needless to say that during the exposure everything in the room must be absolutely still. When a very long exposure is needed the photographer should sit down rather than stand. These precautions may sound absurd, but I can assure those who undertake this work that they will find them only too necessary, and that overlooking them will be the cause of many needless failures.

As regards plates, use isochromatic plates altogether,

and be very careful in developing them not to let them become too dense. Use a slow developer, and keep the plate well under control. On no account use absolutely black grounds, for, as already stated, they detract enormously from the artistic value and beauty of the picture, all the softness and delicacy being drowned by the intense black.

With flowers, leaves, or grasses, very striking and decorative effects may be obtained. Curiously enough, this has seldom been attempted — why, it is difficult to understand, as the work is, comparatively speaking, easy, requiring, of course, a keen sense of the value of lines, of masses, of tones, lights, and shades, just as decorative drawing does. A considerable amount of patience is needed, and perseverance also, if you would find the flowers and leaves that just fit into the scheme.

PART III

PHOTOGRAPHING FUNGI

HERE we come to the easiest kind of photography — easy and at the same time most satisfactory. Many of the fungi are not only beautiful in colour, but their forms and markings are very striking and show to full advantage in a photograph. Take, for example,

JACK IN PULPIT.

May 18, 1901.

such varieties as the different amanita, the delicious morel, or even some of the clevaria: with a little care in arranging them, very beautiful photographs may be made.

In most cases it is advisable to photograph the specimen as it is found growing. With few exceptions, they are unaffected by the wind, so that exposures of almost any length may be made, provided the surrounding vegetation is not easily disturbed by the passing breeze. In all cases where the mushroom is on the ground the camera must be placed low, even within a few inches of the ground. When for any reason it is necessary to remove the mushroom in order to photograph it indoors, be sure to cut a large enough piece of the surrounding earth or bark to show the nature of the location. For carrying such bulky specimens a large flat basket is most convenient, and that must be carried with care or your specimens will break. It is so much easier to carry the camera than the mushrooms that there is every reason why the photograph should be made on the spot. When it is thought necessary to show the root of the mushroom, lay a suitable specimen alongside of the growing one. In any event it is just as well to show the under side, as it is that part which aids so much in the identification of the species.

Isochromatic plates are necessary for all the

brightly coloured varieties, while ordinary plates will answer for those which are of more quiet colour. Almost any lens of moderately long focus will do for this work; the camera should have a long bellows and have back focus and single swing; this latter is made necessary by having to place the camera so near the ground.

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